

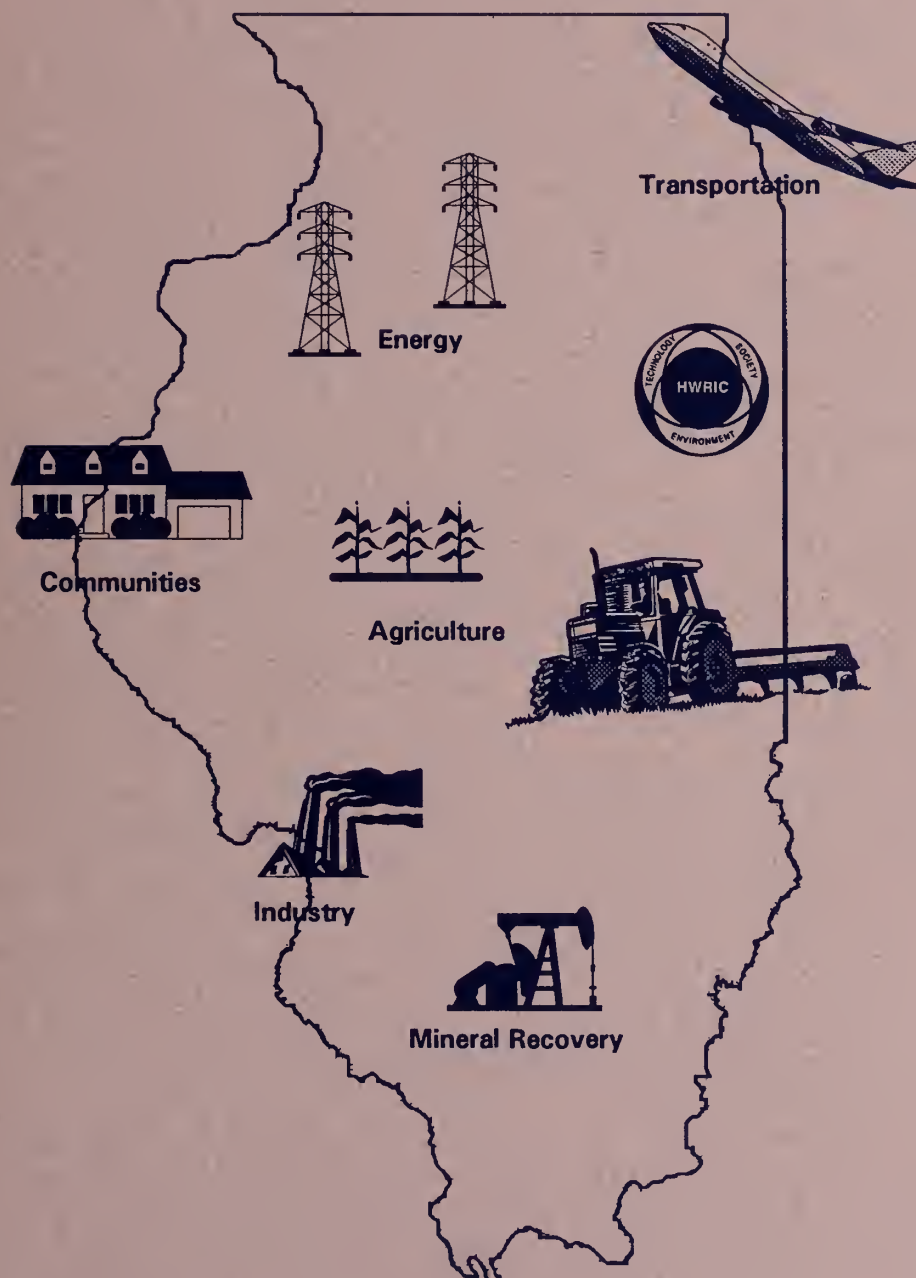
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Hazardous Waste Research and Information Center

FY'92 Annual Report
June 30, 1991-July 1, 1992

HWRIC: Attacking the Waste Management Problems of Illinois



December 1992

About the Cover: HWRIC provides a variety of services to the state's public and private sectors to help us solve our hazardous waste problems.



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HWRIC's Mission

The Hazardous Waste Research and Information Center (HWRIC) was formed within the Illinois Department of Energy and Natural Resources (ENR) in 1984. HWRIC was charged with a mission to combine research and education; information collection, analysis and dissemination; and direct technical assistance to industry, agriculture, and communities. Working with industry to reduce waste at the source and to recycle those wastes that could not be reduced was also a priority. In September 1989 the signing of the Toxic Pollution Prevention Act (TPPA) formalized the Center's programs to include Research, Information Services, Industrial and Technical Assistance, Data Management and Laboratory Services. This Act (Public Act 86-914), which was amended in 1990 by Senate Bill 2253, expanded the Center's five programs to include a Pollution Prevention Program.

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It is my pleasure to present to you the Center's seventh annual report which covers

Fiscal Year 1992. Since the inception of the Hazardous Waste Research and Information Center within the Department of Energy and Natural Resources in 1984, we have continued to grow and to expand our program of providing a non-regulatory focus for the state's hazardous waste and toxic substance activities. The Center combines research with information collection and analysis to provide Illinois citizens, businesses and other organizations with direct technical assistance and educational materials on matters of waste management and pollution prevention.

With the 1990 completion of our 44,000 square foot Hazardous Materials Laboratory on the south portion of the University of Illinois Urbana-Champaign campus, we have greatly expanded our abilities to develop analytical capabilities (see Chapter 2) and to provide research support, technical assistance and information services to the people of Illinois. Our facility is one of only two "State Technology Incubator and Test Evaluation Facilities" recognized by the U.S. Environmental Protection Agency in one of their recent publications.

As described in Chapter 6, pollution prevention is a major program priority of the Center and one that involves almost all staff. The Center looks at this program as a long-term solution to our state's industrial waste problems, and as a way to help companies economically meet present regulatory requirements while increasing their industrial efficiency. The scope of our program is multimedia, examining the flow of all materials in a facility, and the generation and release of all waste. Our library and clearinghouse collections on pollution prevention topics (see Chapter 5) are now the most complete in the Midwest. We are working with USEPA to develop an abstract and bibliographic system of pollution prevention case studies. The Waste Reduction Advisory System is available on diskette from the Center. This system is being coordinated with USEPA's

Pollution Prevention Information Exchange System and the United Nation's International Cleaner Production Information Clearinghouse.

During the coming fiscal year I will be serving as the Chairman for the Advisory Board of the National Roundtable of State Pollution Prevention Programs. I also represent all state pollution prevention programs on the USEPA Administrator's American Institute for Pollution Prevention. These forums have allowed the Center to become nationally recognized and have provided access to valuable information from other state programs which we can pass on to generators and to the people of Illinois.

FY'92 was a time of concern for the maintenance of HWRIC's program. There was a threat to the existence of ENR as an agency and the Center faced large proposed budget cuts. At one point, combined House and Senate proposed cuts would have reduced our budget by 27% over our FY'93 maintenance level. Despite budget cuts approaching 20%, we still look to maintain our basic program and services to the people of Illinois. We are beginning to realize the full potential of the investment the state has made in our Center over the last seven years. But we need to do a better job of informing legislators, industry and the public about the services we provide and the economic and environmental protection that results from these services. Like most research and technology transfer organizations, we are an investment in the future economic and environmental enhancement of our state and our nation. The immediate return on this investment to the state is hard to quantify. We hope the value of our activities, programs, accomplishments and proposed future goals will be apparent to you as you examine this report.

A handwritten signature in dark ink, appearing to read "David Phewas". The signature is fluid and cursive, with a long horizontal stroke at the end.



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Chapter 1. HWRIC Management

A. Introduction

The Hazardous Waste Research and Information Center (HWRIC) is a division of the Illinois Department of Energy and Natural Resources (ENR) and is also affiliated with the University of Illinois, Urbana-Champaign (UIUC). HWRIC's Hazardous Materials Laboratory (HML) is owned and maintained by UIUC. The Center answers to the Board of Natural Resources and Conservation (BNRC), which approves all hiring, firing, promotions, raises and policy issues. HWRIC also relies on a Program Advisory Panel (PAP), the primary function of which is to provide an external source for advice on the Center's overall program. The panel includes representatives from industry, other state agencies, and environmental groups.

B. Structure

A listing of the Center's full-time positions and organizational structure, as of June 30, 1992, appears as Figure 1-1. The state-funded headcount at the end of the fiscal year was 30, although 4 of these positions were lost at the beginning of FY'93 due to budget cuts. Total HWRIC full-time staff (including contract personnel) was 36 at the end of the fiscal year. A number of students and part-time personnel assist in many programs, include the laboratory, library, and administration.

During FY'92 the Center formalized a pollution prevention program within its structure, and placed it under the management of the Assistant Director (see Figure 1-1). This organizational change reflects the priority that HWRIC gives to pollution prevention, and the cross-current programmatic nature of these activities.

C. Fiscal Year Priorities

Recent cuts in General Revenue Funds (GRF) have caused the Center to change the way it funds its activities. Table 1-1 shows the nine-year history (including FY'93) of HWRIC funding. Figure 1-2 graphically illustrates the

fluctuations in HWRIC support. GRF increased through FY'91 (\$1.827 million) but has decreased dramatically over the last two years (\$1.366 million in FY'93).

In FY'90, GRF research reached a high of \$634,000; by FY'93 it was down to \$125,000. Most research dollars now come from the Hazardous Waste Research Fund (HWRF). HWRF increased from \$300,000 in FY'85 to \$400,000 in FY'90 and '91, to \$600,000 in FY'92. However, only \$537,000 of the HWRF will be available in the fund in FY'93. FY'93 will mark the first time HWRIC will receive additional money for research from funds appropriated for solid waste activities.

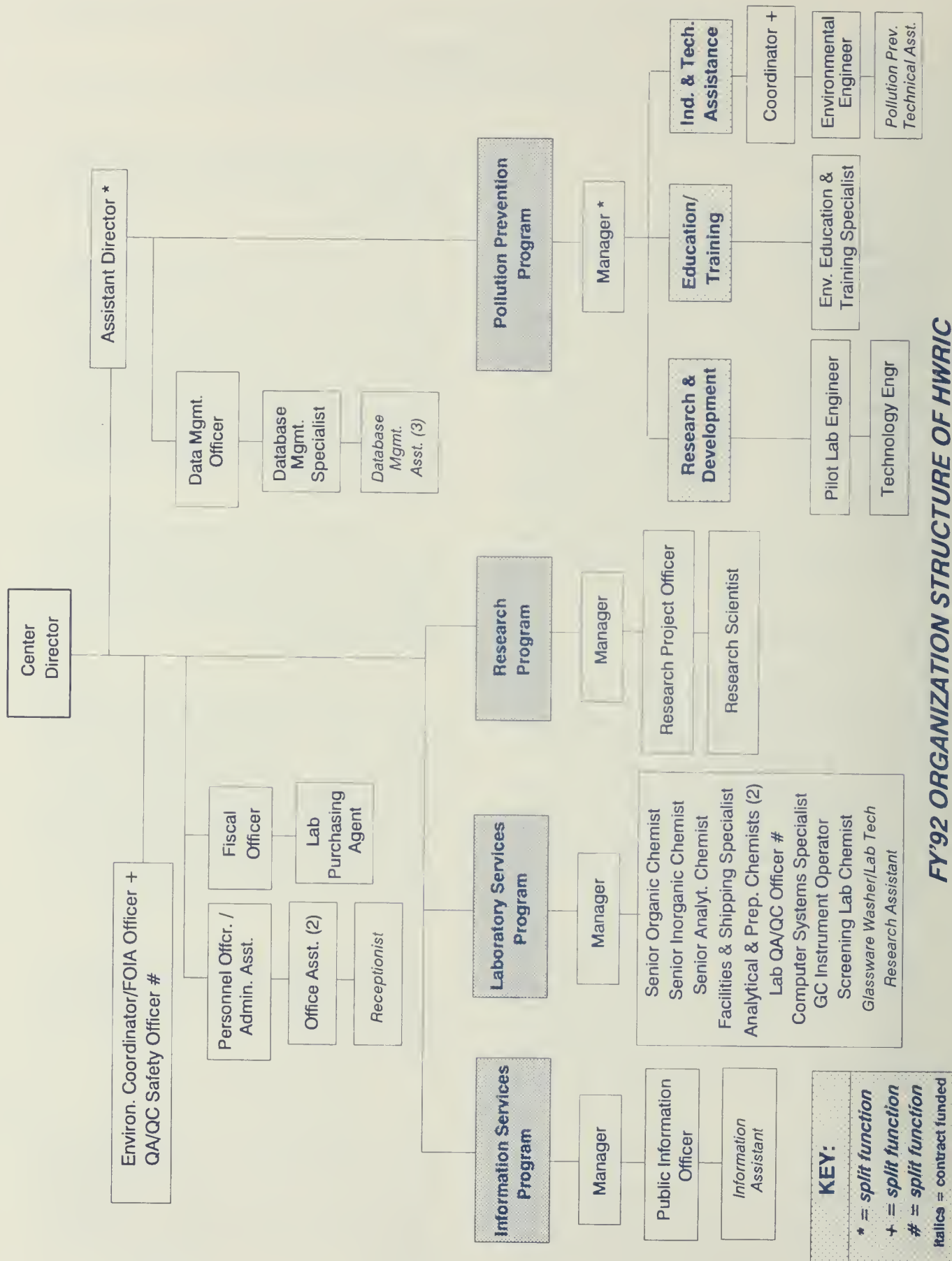
Contract funds went from zero in the 1985-1988 fiscal years to \$360,000 in FY'92. Income from fees and other services has also increased in this period (\$98,000 projected for FY'93), but will still amount to only 3.3% of HWRIC's total budget.

The large peak in funding during the FY'90 through FY'92 period is from allocated funds (Capital Development Board and Build Illinois funds). These were provided to the Center to equip and furnish the HML. Most of the money was spent on analytical equipment for the laboratories. These funds have been expended (about \$490,000 of carry-over money went into FY'93 to cover obligations), and no new allocated funds are anticipated in the near future.

To maintain its programs in the future, it is obvious that the Center will have to rely on additional contract funds, and possibly other state funding sources, to make up for continuing shortfalls in GRF.

D. Ongoing Priorities

A continuing priority of HWRIC is to find financial support to more fully implement the Laboratory Services and Pollution Prevention Programs. For the latter program, HWRIC has expanded efforts to assist Illinois industries in developing more defined pollution prevention programs.



FY'92 ORGANIZATION STRUCTURE OF HWRIC

KEY:
* = split function
+ = split function
= split function
Italics = contract funded

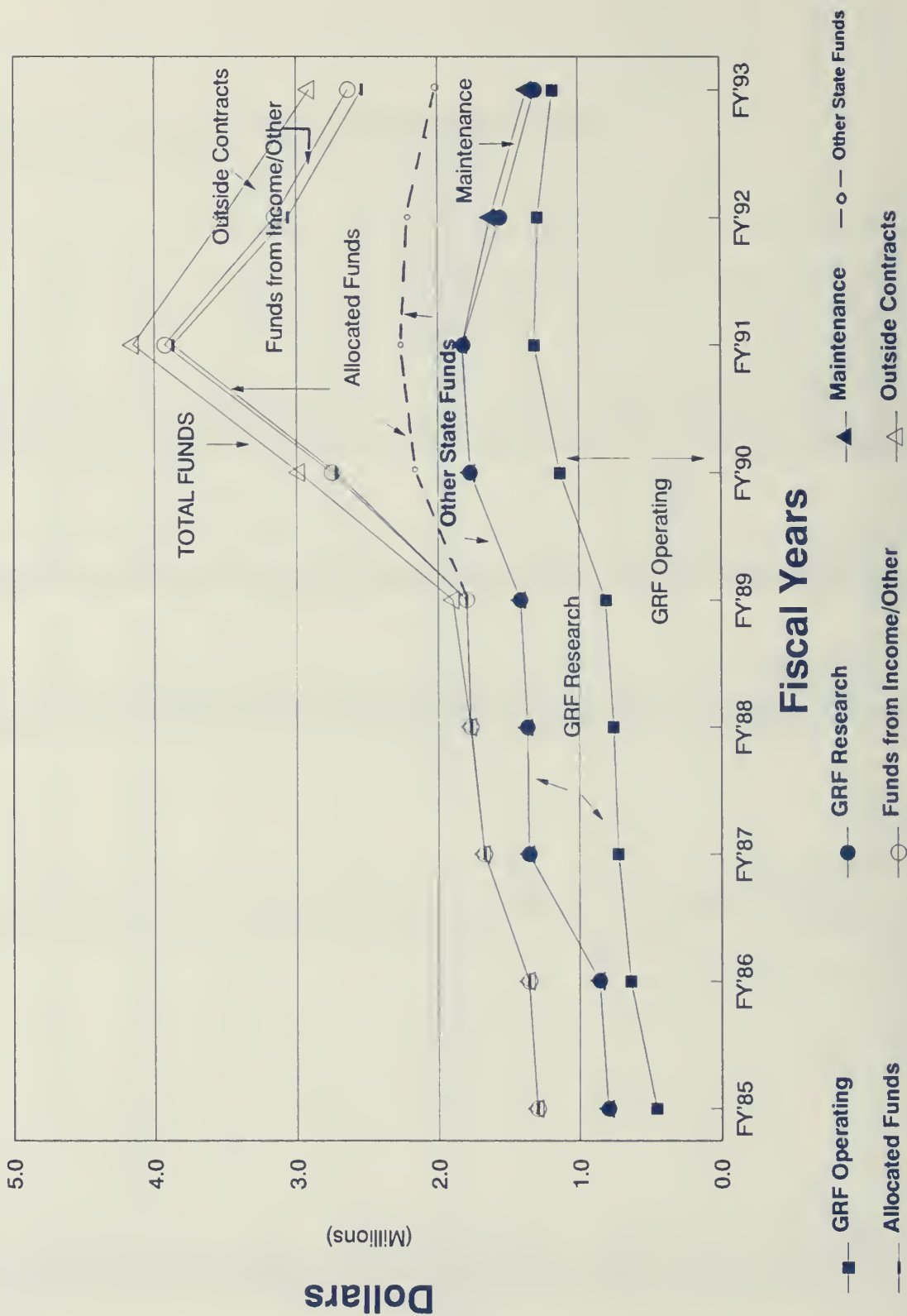
Figure 1-1

Table 1-1

HISTORY OF HWRIC FUNDS BY CUMULATIVE GROUPS										
FUND GROUP	FY'85	FY'86	FY'87	FY'88	FY'89	FY'90	FY'91	FY'92	FY'93	TOTAL
GENERAL REVENUE										
Operating	459.5	643.6	728.9	763.9	814.8	1,137.9	1,317.5	1,290.5	1,181.5	8,338.1
Operating % Grand Total:	35.3%	47.3%	43.5%	43.2%	43.0%	38.2%	31.6%	37.3%	39.5%	38.6%
Research	340.5	215.3	631.9	603.2	603.2	633.9	502.6	266.4	125.3	3,922.3
Research % Grand Total:	26.2%	15.8%	37.7%	34.1%	31.9%	21.3%	12.1%	7.7%	4.2%	18.2%
Building Maintenance	0.0	0.0	0.0	0.0	0.0	0.0	7.0	11.8	11.8	30.6
Maintenance Major Eq	0.0	0.0	0.0	0.0	0.0	0.0	0.0	57.5	47.5	105.0
Maintenance % Grand Total:	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%	2.0%	2.0%	0.6%
TOTAL GRF:	800.0	858.9	1,360.8	1,367.1	1,418.0	1,771.8	1,827.1	1,626.2	1,366.1	12,396.0
Total GRF % Grand Total:	61.5%	63.1%	81.2%	77.2%	74.9%	59.4%	44.0%	47.0%	45.7%	57.4%
OTHER STATE APPROPs										
PUF	200.0	200.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	400.0
HWRP	300.0	300.0	315.0	400.0	380.0	400.0	400.0	600.0	537.1	3,632.1
Solid Waste	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0
TOTAL Other State:	500.0	500.0	315.0	400.0	380.0	400.0	400.0	600.0	637.1	4,132.1
% Grand Total:	38.5%	36.8%	18.8%	22.6%	20.1%	13.4%	9.6%	17.4%	21.3%	19.1%
ALLOCATED FUNDS										
Build Illinois	0.0	0.0	0.0	0.0	0.0	19.6	383.1	110.0	0.0	512.7
CDB	0.0	0.0	0.0	0.0	0.0	528.9	1,258.9	667.9	544.3	3,000.0
Solid Waste (ENR Allocation)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	40.0	40.0
TOTAL Allocated:	0.0	0.0	0.0	0.0	0.0	548.5	1,642.0	777.9	584.3	3,552.7
% Grand Total:	0.0%	0.0%	0.0%	0.0%	0.0%	18.4%	39.6%	22.5%	19.5%	16.5%
FUNDS FROM INCOME/OTHER										
NRIF	0.0	0.0	0.0	0.0	0.0	6.7	6.7	1.5	5.0 est.	19.9
TPPF	0.0	0.0	0.0	0.0	0.0	0.0	2.0	6.9	8.0 est.	16.9
SPF (Teepak)	0.0	0.0	0.0	0.0	0.0	20.2	36.6	14.2	0.0	71.0
Service/HML Fees	0.0	0.0	0.0	0.0	0.0	0.0	10.5	70.0	70.0 est.	150.5
Revolving	0.0	1.4	0.1	3.0	1.1	0.0	0.0	0.0	0.0	5.6
Unrestricted	0.0	0.0	0.0	0.0	0.0	0.4	0.3	0.4	14.8	15.9
TOTAL Income:	0.0	1.4	0.1	3.0	1.1	27.3	56.1	93.0	97.8	279.8
% Grand Total:	0.0%	0.1%	0.0%	0.2%	0.1%	0.9%	1.4%	2.7%	3.3%	1.3%
OUTSIDE CONTRACTS										
RITTA (DT)	0.0	0.0	0.0	0.0	94.7	111.8	0.0	0.0	0.0	206.5
WRAS/PPIC EPA PO (GM)	0.0	0.0	0.0	0.0	0.0	9.4	0.0	0.0	0.0	9.4
CERL I (MP)	0.0	0.0	0.0	0.0	0.0	34.8	0.0	0.0	0.0	34.8
WRITE (GM)	0.0	0.0	0.0	0.0	0.0	77.0	79.9	100.0	0.0	256.9
WES (MP/AW)	0.0	0.0	0.0	0.0	0.0	0.0	50.2	90.9	0.0	141.1
PPIG (DT)	0.0	0.0	0.0	0.0	0.0	0.0	50.0	50.0	0.0	100.0
DYNAMAC (MP)	0.0	0.0	0.0	0.0	0.0	0.0	13.4	0.0	0.0	13.4
WRAS/PPIC (GM)	0.0	0.0	0.0	0.0	0.0	0.0	30.0	30.0	35.0	95.0
CERL II (MP)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	89.7	0.0	89.7
CERL III (MP)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	58.2	58.2
CERL -- QI (GM)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	34.7	34.7
Environmental Prot. Trust	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27.3	27.3
Industrial D -- Database	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0
Industrial D -- PP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0	50.0
TOTAL Outside Contracts:	0.0	0.0	0.0	0.0	94.7	233.0	223.5	360.6	305.2	1,217.0
% Grand Total:	0.0%	0.0%	0.0%	0.0%	5.0%	7.8%	5.4%	10.4%	10.2%	5.6%
GRAND TOTAL:	1,300.0	1,360.3	1,675.9	1,770.1	1,893.8	2,980.8	4,148.7	3,457.7	2,990.5	21,577.6

Figure 1-2

HISTORY OF HWRIC FUNDS BY CUMULATIVE GROUPS



During FY'93 a pollution prevention planning guide will be distributed to selected industries to begin testing its effectiveness as a planning tool. Based on comments received from this pilot distribution, the document will be revised and made widely available to Illinois industries.

HWRIC staff continue to expand efforts to promote pollution prevention at institutions of higher learning in Illinois. In FY'93 at least one project to develop curricula related to pollution prevention will be funded. Pollution Prevention staff will continue development of materials for distribution to teachers, such as the "Product Life-Cycle Analysis" activities sheet for grades 7-12 completed at the end of FY'92.

Industrial non-hazardous solid waste is a growing issue and one to which HWRIC will give more attention in FY'93. The Center has two contracts with the US Environmental Protection Agency (USEPA) to better define this waste problem in Illinois. A portion of HWRIC research funds is being devoted to industrial solid waste issues, particularly pollution prevention and recycling strategies.

HWRIC staff have conducted a number of pollution prevention research projects with industry in the Center's laboratory and will continue to seek sound projects that will lead to a reduction of problematic wastestreams through new technologies and techniques.



Chapter 2. Laboratory Services Program

A. Introduction

The Laboratory Services Program (LSP) is designed to provide analytical and logistical support to researchers working with hazardous waste. The Hazardous Materials Laboratory (HML), a 44,000 square foot facility which houses all activities of the Center, includes approximately 20,000 square feet of laboratory space. This space is partitioned between the analytical functions of the LSP staff and the research laboratory space. The latter space is accessible to researchers who wish to avail themselves of the special design characteristics of these laboratories. Access is granted to researchers on a case-by-case basis with consideration given to project relevance, safety, compatibility, and other factors. The user is assessed a fee only for the maintenance and management costs borne by the Center. More information on the HML's laboratory facilities can be found on pages 6-8 of the HWRIC FY'91 Annual Report.

B. Project Support Activities

LSP staff involvement in project support has evolved into several distinct mechanisms since the opening of the facility in 1990 (see Table 2-1). The client base includes researchers from the scientific surveys and from the University of Illinois at Urbana-Champaign (UIUC); researchers from diverse locations who have received funding through HWRIC's Research Program; industrial clients attracted through other HWRIC program outreach efforts; and federal agencies such as the US Army Corps of Engineers. Some of these clients seek to use the HML's facilities to conduct all or some portion of their research efforts. Others are conducting their research activities in their own laboratories, but enlist the LSP to provide analytical and other types of support.

HWRIC laboratory staff are involved with the conduct of research projects for many pilot laboratory and related industrial support efforts. Such projects are often aimed at evaluating the effectiveness of an evolving

Table 2-1

Project Support Mechanisms	
Support Area	Client Served Support Provided
HWRIC Funded Projects	Projects conducted at the HML or at the facilities of the principal researcher. The LSP provides analysis of samples for primary quantitation and for quality assurance purposes.
In-House Projects	Projects conducted in the pilot lab or by HWRIC staff in the field, often in direct support of industry. The LSP provides analytical methods development and sample analyses, as well as logistical assistance.
External Researchers	Researchers working independently of the Center who do not have access to the analytical capabilities needed to carry out their projects. The LSP provides analytical methods development and sample analyses as requested.
LSP Contracts	LSP staff have obtained several federal government contracts to support research efforts by various agencies. Contracts generally involve agency staff conducting at least part of the research effort within the HML. LSP staff provide analytical and logistical support and methods development. In several cases, the LSP provided literature research using a contract employee. Some of these contracts included provisions for LSP staff-directed research.

pollution prevention or treatment technology on specific waste streams. The LSP works closely with staff from other programs to provide the sample analyses needed to evaluate project success.

The LSP has obtained several federal agency contracts to provide analytical and other support for specific research efforts. Generally, the program provides analysis of samples collected as part of the research effort. In some instances, the funding agency provides personnel and materials to conduct the project within the HML. In others, the samples are collected through field or other efforts away from the HML. HWRIC involvement in such longer term projects permits more equal distribution of the analytical workload over the year (these projects become the focal point when other efforts abate), allows the staff to explore challenging analytical problems, and helps to keep the laboratory instrumentation in a state of operational readiness. These contract projects contribute much-needed resources for operation and maintenance of the laboratory equipment.

Specific Project Support Efforts in FY'92

The LSP was involved in a variety of projects during the fiscal year. Some of these projects, divided into groups based on support mechanism (see Table 2-2). Some projects challenged the capabilities of the program instrumentation and staff, while others encompassed more routine types of analysis. A few of the more interesting projects are discussed briefly below.

♦ *Argonne National Laboratory/UIUC Forestry Department.* This project is driven by a need to find innovative methods to define the extent of near surface groundwater contamination. The researchers hypothesized that cottonwood and other trees growing along streams in relatively dry climates, such as Nebraska and Kansas, would translocate volatile organic contaminants (VOCs) from the groundwater into their plant tissues. If the VOCs could be measured in relatively easily collected samples of tree tissue, then the extent of ground water contamination could be mapped based on location of VOC-containing trees.

The project researchers, with guidance from LSP staff on the problems associated with working with VOCs in aqueous solution, grew cottonwood saplings exposed to carbon tetrachloride under controlled conditions. LSP staff received subsamples of leaf, stem, and root tissue from these trees. They developed methods to prepare these samples and analyze them for VOCs, specifically carbon tetrachloride, while minimizing loss of the compound to

volatilization. Results of the laboratory work were sufficiently promising to convince Argonne to pursue field sampling to further evaluate the potential of this approach. Methodologies and instrument modifications developed during this project formed the basis for two posters presented at the International Symposium on Capillary Chromatography Annual Meeting in Baltimore and a presentation at the regional meeting of the Association of Official Analytical Chemists (AOAC) in Champaign.

♦ *Construction Engineering Research Laboratory (CERL), US Army Corps of Engineers.* HWRIC entered into a contractual agreement with CERL to provide methods development and analytical support for a number of chemical compounds of interest to the Army. These compounds, specifically dinitrotoluene sulfonates, are produced as waste products in the production of trinitrotoluene (TNT), rendering the waste "redwater" unacceptable for disposal. Program staff developed high performance liquid chromatography (HPLC) methods suitable for quantitation of the major components of interest. HWRIC subcontracted with SRI, International to prepare analytical standard materials, unavailable commercially, for several sulfonates and other redwater components.

HWRIC continues to support efforts by CERL to develop treatment methodologies that will render the redwater innocuous and acceptable for disposal. These experiments, conducted by CERL staff in the HML, focused on the application of wet air oxidation treatment to the wastewater. The HPLC methods developed here have been applied to the redwater samples before and after treatment, and have clearly demonstrated the degree of destruction of these key components as a result of the treatment process. HWRIC provided toxicity testing on the wastewaters before and after treatment.

♦ *Graham Plating.* As part of a pollution prevention study funded by USEPA, HWRIC staff evaluated the potential for reuse of plating rinsewater in a nickel plating line at Graham Plating located in Chicago. The details of the pilot scale treatment investigations performed on the wastewater are provided in Chapter 3.

Table 2-2

FY'92 LSP Support Projects	
HWRIC-Funded Projects	Support Provided
Vermette/State Water Survey	Analysis of selected PCB congeners in air samples collected at Crab Orchard National Wildlife Refuge. Analysis was by GC & GC/Ion Trap MS.
Taylor & Fuessle/Bradley University	Determination of arsenic forms in waste samples using ion chromatography and pulsed amperometric detection.
In-House Projects	Support Provided
Graham Plating	Nickel, total organic carbon and sulfate analysis on waste rinsewater samples processed by reverse osmosis and vacuum evaporation in HWRIC's pilot lab.
P&H Plating	Zinc and selected cyanide analysis on samples collected at various locations at the plating facility in Chicago.
R.B. White Company	Analysis for total organic carbon and phosphate in sample of cleaning bath wastewaters processed by ultrafiltration in HWRIC's pilot lab.
Lonza Engineering	Product amine, total organic carbon and total Kjeldahl nitrogen analyses in support of a HWRIC RRT study investigating the applicability of various treatment alternatives to Lonza's production wastewater.
External Researchers	Support Provided
Peden/State Water Survey/Martinsville Project	Analysis by GC/MS of contaminants in samples from the proposed low-level radioactive waste disposal site.
Argonne National Laboratory/UI Forestry Department	Methods development and GC analysis for carbon tetrachloride in root, stem and leaf tissues of cottonwood trees.
UI Landscape Architecture Department	Heavy metal screens of soil samples from areas in East St. Louis proposed as sites for neighborhood gardens.
Vermette/State Water Survey/US Geological Survey Project	ICP/MS analysis for selected heavy metals in rainfall samples, leading to the development of a new method for such low level analyses.
LSP Contracts	Support Provided
Construction Engineering Research Laboratory (US Army Corps of Engineers)	HPLC methods development and analyses on samples of redwater before and after treatment by CERL staff within the HML.
Waterways Experiment Station (US Army Corps of Engineers)	TCLP testing, metals and volatile organic chemical analyses in support of a treatment project being conducted by WES staff within the HML.
Dynamac/US EPA	Analysis for specific PCB congeners by GC and GC/Ion Trap MS in soil samples collected by US EPA staff at a Superfund site in Florida.

The LSP staff performed nickel, sulfate, and total organic carbon analyses on samples collected before and during the treatment evaluations. These data defined the relative effectiveness of two recycling/reuse alternatives being evaluated and argue strongly for the feasibility of total in-plant reuse of this particular wastestream.

♦ *Vermette/State Water Survey.* HWRIC funded this project to establish pre-cleanup air quality in the vicinity of known polychlorinated

biphenyl-contaminated sites at the Crab Orchard National Wildlife Refuge in southern Illinois. Vermette's staff collected numerous air samples over approximately a 12-month period, prepared the samples within the HML, and delivered these to the LSP for analysis. A group of about 30 polychlorinated biphenyl (PCB) congeners, considered representative of the total PCB load, was selected for quantitation. Using gas chromatography supplemented with ion trap mass spectrometry, the LSP staff was able to clearly show the elevated PCB levels in the air

samples collected nearest the contaminated sites. Further, the mass spectrometric work revealed the presence in these samples of another group of chlorinated contaminants, polychlorinated naphthalenes (Halowaxes), which had not been previously identified, but which have toxicological and chemical properties similar to PCBs. A follow-up study is being considered after remediation work is completed at the site. The site will also be the source of samples for a HWRIC-funded toxicological evaluation being conducted by UIUC School of Veterinary Medicine personnel; the LSP will provide analytical support to this effort as well.

♦ *United States Geological Survey (USGS)/Vermette.* The USGS is developing a precipitation sampling network that will be used to collect samples for the assessment of heavy metal levels in rainfall. Preliminary studies focused on the development of sampling protocols and analytical methods of sufficient sensitivity to quantitatively measure the very low levels of selected metals in rainfall. HWRIC was selected to participate in the development of analytical methodologies centered around the HML's inductively coupled plasma/mass spectrometer (ICP/MS) instrumentation.

LSP staff participation in round robin and other evaluative studies clearly demonstrated the advantages of applying ICP/MS to this particular sample matrix. The ICP/MS-based methods developed by LSP staff will form the basis for the analytical methods to be adopted by USGS for the longer term studies. The project efforts were presented at the Pittsburgh Conference in New Orleans and at the regional AOAC meeting in Champaign.

C. Laboratory Development

Staffing

Two new positions in the program allowed some rearrangement/promotion of existing staff and the acquisition of new technical support personnel. The new Gas Chromatography (GC) Chemist position was filled from existing staff, facilitating promotion of a chemist whose skills and responsibilities had grown substantially during his tenure at the HML. The Screening Lab Chemist position was filled with a contractual staff employee with significant industrial experience. Two additional contractual staff were appointed to the

Laboratory Technician positions vacated by promotion and resignation.

These changes brought the Laboratory Services Program General Revenue Fund (GRF) supported staff to 11 including 3 senior chemists, an instrumental chemist, 3 technician level chemists, a shipping/building coordinator, a computer systems specialist, a quality assurance and safety person, and the Laboratory Services Program Manager. This group offers a broad range of capabilities in analytical chemistry with expertise in inorganics, metals, and gas and liquid chromatography-definable organics. LSP chemists have strong backgrounds in environmental analytical areas, have experience in some areas of environmental chemistry, and are rapidly broadening their experience with respect to industrial wastes. They often work with researchers to attempt to maximize the interface between sample generation/collection and the analytical process. Each of the primary chemists continues to carry operational and maintenance responsibilities for several major analytical systems.

The addition of the new positions in FY'92 brought the program to a minimal staffing level for safe and effective operation of the laboratories. Unfortunately, the budget crisis effectively removed the gains made during the fiscal year, resulting in the loss of 1.5 full-time equivalent positions, including the Quality Assurance/Quality Control-Safety Officer.

Instrumentation

The purchase of instrumentation and equipment for the laboratories was completed as all remaining Capital Development Board (CDB) equipment funds were allocated. Major systems added during the fiscal year included a second Gas Chromatograph/Ion Trap Mass Spectrometer; a High Performance Liquid Chromatograph/Mass Spectrometer; an Ultraviolet/Visible Spectrophotometer; a Total Carbon Analyzer; a Total Organic Halogen Analyzer; a Capillary Zone Electrophoresis Analyzer; and a Gas Chromatograph/Fourier Transform Infrared (FTIR) system. Additional sample preparation equipment was also purchased including a grinder, sample splitters, and organic solvent concentrators.

With receipt, installation, and training on these final analytical systems, HWRIC will be able to offer broad-based analytical capabilities

Table 2-3

LSP Analytical Instrumentation/Equipment		
Organic Analyses	Inorganic Analyses	Additional Capabilities
Gas Chromatographs (Including Multi-Dimensional GC) Specific Detectors: Flame Ionization Nitrogen/Phosphorus Photoionization Electrolytic Conductivity Sulfur Chemiluminescence Electron Capture Atomic Emission Fourier Transform Infrared Spectrometer Ion Trap Mass Spectrometer Magnetic Sector/Quadrupole MS/MS Sample Introduction: Autosamplers Purge and Trap Static Headspace Liquid Chromatographs (Including Carbamate Post-Column Derivation) Specific Detectors: Fixed Ultraviolet Differential Refractometer Diode Array Ultraviolet/Visible Scanning Fluorescence Quadrupole Mass Spectrometer Capillary Zone Electrophoresis Gel Permeation Chromatograph Supercritical Fluid Chromatograph Total Organic Carbon Analyzer Total Organic Halogen Analyzer Infrared Spectrometer	Atomic Absorption Spectrometer Graphite Furnace Hydride Generation System Inductively-Coupled Plasma/Mass Spectrometer Ion Specific Electrode Meter Flow Injection Analyzer Ion Chromatograph Specific Detectors: Conductivity Pulsed Amperometric Ultraviolet Spectrometric	Liquid Scintillation Microtox Toxicity Screening Ultraviolet-Visible Spectrometry Supercritical Fluid Extraction Soxtec Extraction TurboVap Solvent Recovery Concentration Derivatization Rotary Evaporation Spinning Band Distillation Ammonia Distillation Cyanide Distillation Turbidimetry pH Measurement Dissolved Oxygen Measurement Conductivity Measurement TCLP Testing Jar Testing Soil/Solids Grinding Solids Subsampling Soil Sieving Flash Point Testing Microwave Digestion Drying Balance Freeze Drying (Lyophilization)

for a variety of inorganic and organic analytes in environmental and waste samples. Table 2-3 summarizes the analytical instrumentation and support equipment available in the laboratory.

Analytical Experience Base

Nearly every analytical support effort brings challenges in the form of new analytes in difficult environmental matrices. LSP chemists are often faced with analytes that are not regulated; and, therefore, not included in

analytical methods guides. Alternatively, the analytes to be determined are in extremely complex industrial wastewaters or other samples for which commonly used preparation and analytical methodologies are inappropriate. Such analytes necessitate methods development.

Most analyses necessitate some sample pretreatment to isolate or release the analytes of interest from the sample matrix in which they occur. Pretreatment (or sample preparation) is required to accommodate the available options

for introducing the samples into the analytical instrumentation, to optimize the way in which that instrumentation processes the samples, or to deliver the analyte in a concentration range amenable to the instrument. Pretreatment methods development might be as straightforward as applying appropriate dilution or digestion schemes to yield the analyte in the proper chemical form and concentration. However, it often involves far more effort. For example, in the Argonne project, considerable effort was expended in developing ways to liberate the analyte, carbon tetrachloride, from the tree tissue to facilitate analysis. Various techniques were explored for grinding the tissue while minimizing heat and air exposure to prevent losses of the highly volatile analyte. The final method involves grinding the sample in a closed container at controlled speed. The sample is chilled during the entire grinding and transfer process. Some losses still occur during preparation, but analysis of samples prepared in this fashion has shown that much of the analyte is retained through this process.

While sample preparation often poses the most complicated problems in methods development, lack of well-proven instrumental methods can also encumber sample analysis. Analysis methods development for inorganic components routinely involves evaluation of any effects the sample matrix might have on the instrumental response to a given analyte. For organic components analyzed by chromatographic methods, it is often necessary to explore the proper combination of instrumental parameters (temperatures, solvents, flow rates, column types, detectors) that will optimize the separation of the analytes and allow accurate and reproducible quantitation. Thus, for separation of the redwater components in the CERL project, various combinations of HPLC conditions and separation techniques were evaluated in time-consuming trial and error fashion. The conditions chosen involved a specific type of chromatographic separation called reverse phase ion-pairing. A mixture of three solvents (water containing the ion-pairing reagent, methanol, and acetonitrile) is used to effect the separation of components of interest with the composition of the solvent programmed to change during the course of the analyses. In this case, detection is achieved in a straightforward manner, using an ultraviolet (UV) detector.

As the program chemists work through the methods development process and then provide the requested analytical information, HWRIC's analytical competence continues to grow. Table 2-4 summarizes some of the chemicals with which HWRIC has successfully worked during the first two years of laboratory operation. This table also identifies the diverse types of sample matrices with which LSP staff have been presented. This list of analytes and matrices will continue to expand as HWRIC's Laboratory Services Program provides analytical support to a variety of clients.

D. Program Objectives for FY'93

Budget constraints will increasingly influence the direction and focus of the Laboratory Services Program in the next fiscal year. Operating, equipment maintenance, and program development costs must continue to be met if the HML is to grow into an effective research and analytical support facility. Decreasing GRF resources will tend to slow program development and force HWRIC to pursue alternative sources of revenue. Federal contracts and industrial clients outside of HWRIC's direct research activities will be pursued as potential sources of needed revenues.

Program development will continue to be a focus of the LSP. Improving analytical capabilities in the current budgetary climate translates into expanding the skill levels of existing staff. Staff training will be addressed in distinct areas:

- ♦ instrument-specific training provided by the instrument vendors;
- ♦ theory and practice training for less experienced staff on specific types of analyses, eg., gas chromatography - this will be addressed through formal courses offered by instrument vendors or private training groups; and,
- ♦ in-house training of chemists, focusing on the development of instrument, data handling, and computer proficiency, which will be provided by senior staff.

The goal is to raise analytical competence to allow the program staff to process more samples and do more varied analyses with existing staff.

Table 2-4

Examples of Analyses Performed

Analytes	Sample Matrix	Analytes	Sample Matrix
Organics:		Inorganics:	
Atrazine & Degradation Products	Runoff Water	Heavy Metals	Plating Sludges Plating Rinse & Wastewaters Soils Rainwater Samples Industrial Slag
Nitrogen/Phosphorus Pesticides	Well Water	Arsenic & Selenium	Coal Leachates
PCB Congeners	Aquifer Soils Air Samples Captured on XAD Resin	Arsenic Species	Industrial Wastewaters
Polychlorinated Naphthalenes (Hallowaxes)	Air Samples Captured on XAD Resin	Boron	Plating Wastewaters
Dieldrin, DDE, DDT, Lindane, Aldrin, & Hexachlorobenzene Confirmation (MS)	Air Samples Captured on XAD Resin River Sediments	Free & Complex Cyanides	Plating Wastewaters
Picloram & DCPA Confirmation (MS)	Water Samples	Sulfate	Plating Rinse Waters Bio-Treated Water
Polynuclear Aromatics Confirmation (MS)	Air Samples	Phosphorus	Industrial Cleaning Baths
Chlorinated Acetals	Tar Sample (Superfund Site)	Chloride; Fluoride	Water
Carbon Tetrachloride	Cottonwood Tree Leaf, Stem & Root Tissue		
Aviation Fuel; Tetrachloroethene	Water		
Trichloroethene	Water, Soil, TCLP Extract, & XAD Resin		
Volatile Organics	Water		
Tertiary Amines	Amine Production Wastewaters		
Dinitrotoluene Sulfonates & Related Contaminants	TNT Production Wastewaters		
Proprietary Brighteners & Carriers	Metal Plating Bath Waters		
Total Organic Carbon	Plating Rinse Waters Industrial Cleaning Baths Amine Production Wastewaters		
Total Kjeldahl Nitrogen	Amine Production Wastewaters		
Unknown Screens by MS & AED	Various Environmental & Industrial Samples		

One important component of these training activities will be compensating for loss of the QA/Safety Officer. Responsibilities for safety regulations have already been shifted to another experienced program staff member. An effort will be made to provide this person with training on laboratory safety, including familiarization with Occupational Safety and Health Administration (OSHA) and other regulations. QA responsibilities are currently being shared by three people in the administrative area. Ultimately, HWRIC will need to formally assign QA responsibilities to one individual with at least a 50% time commitment and to provide some QA training.

The Laboratory Services Program will explore better ways to support HWRIC's pilot testing activities. Such activities are crucial to the longer-term effectiveness of the Center in addressing pollution prevention with Illinois industry. An expanded role for LSP staff is envisioned in the project development and conduct phases. Increased interaction of LSP analytical staff in such activities will enhance interest in the project and ensure that analyses performed are consistent with project needs.

Another focal point for the coming fiscal year will be in the area of time accounting and billing. The current system will be analyzed and optimized while insuring that billing is complete, fair, and consistent with UIUC guidelines.

The LSP remains committed to the development of ties with other UIUC campus units, particularly the Chemistry and Civil Engineering Departments. Student employment, training programs, and opportunities for joint research activities will be explored. HWRIC will also make a more concerted effort to advertise HML laboratory capabilities on campus to attract additional research projects. Many of these activities are envisioned to be within the purview of a research liaison, a position that should be filled in FY'93. The liaison would also be active in pilot lab projects and in enhancing the current accounting system.

The initiation of an Industrial Affiliates Program remains a goal for the Center. LSP staff will work closely with Administrative Program staff to define the Affiliates program concept, probably using models already functioning within the UIUC. Industry interest will be explored, and an attempt will be made to initiate the program during the fiscal year. Revenues

from this program would be used to further HWRIC goals in waste management and pollution prevention, and to develop a capital equipment replacement fund.



Chapter 3. Research Program

A. Introduction

Seeking solutions to Illinois' hazardous waste problems has been the primary objective of the Center's Research Program. To achieve this goal, HWRIC has solicited research ideas from investigators throughout the state and the nation, and provided financial and technical support to those researchers whose proposals addressed the most important waste management issues facing Illinois. The findings of these Center-funded studies are made available to the public as reports, factsheets, and brochures. Research results are presented by Center-funded researchers and HWRIC staff at technical meetings and are frequently published in peer reviewed journals.

Previous HWRIC annual reports included sections that described in detail the Center's Research Program. The FY'90 and FY'91 Annual Reports provide a complete documentation of the development of the program, and its activities and accomplishments from FY'86 through FY'91. This year, the Research Program chapter focuses on the current direction and success of the program; concluding with a brief discussion of the program plans for FY'93. Recently completed projects and current projects are summarized at the end of the chapter.

Research funding began in 1985-86 by focusing primarily on characterizing site contamination problems and tracking the movement of contaminants through the environment. In 1987-89, the focus shifted to identifying and evaluating technologies for cleaning up contaminated areas. The 1990 project focus was on exploring technologies to treat wastes from industrial processes. Current (1991-92) projects concentrate on assessing techniques and technologies to reduce wastes at the source and to quantify the risk these wastes pose to the public and the environment.

Assessing and remedying existing problems, and finding ways to eliminate or at least reduce future problems, are efforts that require considerable expenditures of time

and money. Unfortunately, there have been dramatic reductions in the amount of money available for this work. State support for research has fallen from a high of \$1,034,000 in FY'90 to \$866,400 in FY'92 (see Table 3-1).

Table 3-1

Research Program Funding FY'89 - FY'93	
Fiscal Year	Funding Level (\$)
89	983,200
90	1,033,900
91	902,600
92	866,400
93	662,388

The amount appropriated for FY'93 research efforts is \$662,388, and further reductions in funds are possible in FY'94. Research Program staff have tried to stretch these dwindling funds by:

- ♦ supporting projects that build on work in progress or just completed;
- ♦ seeking additional funding from other state, federal, and private sources; and
- ♦ jointly sponsoring projects with other agencies and with industry.

Projects that address an urgent problem for the state, and that have the greatest promise of success, are the only ones that can be chosen considering the limited funds that can be awarded. Some of the projects that were chosen in FY'92 as best meeting these criteria are highlighted below.

B. FY'92 Project Highlights

HWRIC supported 33 projects during FY'92 carried out by investigators from the state scientific surveys, public and private state universities, other state agencies, consultants,

and industries and small businesses. These research efforts can be grouped into three areas of emphasis: promotion of pollution prevention technologies and techniques; development and evaluation of contaminated soil and water remediation technologies; and assessment of the threats that contaminants pose to the environment and human health.

Pollution Prevention Techniques and Technologies

During this fiscal year, HWRIC continued to support work to address waste management issues at institutions of higher education. Attempts were made to obtain more information on the needs of Illinois colleges, universities, and junior colleges regarding their waste generation and handling problems. Center staff worked with several institutions to address their individual needs. A survey that will further define HWRIC's role in aiding Illinois centers of learning, both in complying with regulations and instituting pollution prevention programs, will be administered during FY'93. Two projects directly involved with minimizing waste from campus teaching and research laboratories were funded in FY'92.

Determination, Implementation, and Evaluation of Laboratory Waste Minimization Opportunities documented existing laboratory practices at six different types of laboratories on the University of Illinois at Urbana-Champaign (UIUC) campus. The goal of the project was to identify common problems and find solutions that would reduce waste generation at the source. Principal investigator Mr. Peter Ashbrook and his staff evaluated chemical substitution, chemical recovery and reuse, chemical exchange, and minimized chemical usage during the project. The project team developed a self-administered audit to assist researchers and laboratory managers on the UIUC campus to assess and track their chemical usage and waste generation. Although the final project report will document problems and solutions to waste generation at UIUC chemistry laboratories, the recommendations will be applicable to universities and colleges throughout the state. The final report for this study should be available from HWRIC in February 1993.

In the second project, *Automated Database Tracking of Chemical Usage*, UIUC researcher Dr. John Ableson and his colleagues

developed a personal computer (PC) based program to track the flow of chemicals through a campus department. The automated system is designed to facilitate waste minimization by:

- ◆ eliminating unnecessary duplications in purchasing of chemicals
- ◆ encouraging internal recycling of unused chemicals, and
- ◆ fostering improved waste disposal practices.

The program has been tested successfully in the UIUC Department of Civil Engineering. HWRIC has granted the researchers' request for additional funding to install the program in other departments at UIUC as well as at other institutions. This year of testing in different facilities with different needs will enable refinement of the program to make it more suitable to a broad audience. This work will be completed in FY'93.

HWRIC's technical assistance to industry includes identifying ways that companies can enhance source reduction activities (see Chapter 6). If a company is not practicing pollution prevention, HWRIC staff can assist in the development and initiation of such a program. HWRIC research funds are used to help address technology needs critical to the implementation of pollution prevention strategies. Two FY'92 projects used research funds to support waste reduction and recycling efforts with industry.

Center staff pilot-tested a vacuum evaporation unit for recovery of metals from plating bath rinsewaters. The goal of this project, *Hazardous Waste Reduction: An Integrated Approach to Alternative Technologies*, was to evaluate this technology as an effective means of removing plating bath chemicals from plating rinsewaters so both the chemicals and the clean water could be reused in the plating operations. HWRIC's evaluation verified that this technology could be used to recover plating bath chemicals and clean the rinsewater for reuse. A full scale unit has been purchased by the company and should be in operation during FY'93. This is a good example of how in-process recycling and metals recovery can be achieved through process modification.

In the second project, *Brine Utilization Research*, HWRIC staff looked at ways to purify a brine solution contaminated by amines, so the salt could be recovered and used. The company,

with assistance from HWRIC engineers, has explored the use of electrohydrolysis and crystallization to remove the amine contaminants and recover a usable salt product. Additional work is planned using ultrafiltration for the separation. Economic analysis of the processes and determination of salt quality still need to be completed. Once these data are available, the most cost effective technology will be selected for implementation.

HWRIC will survey members of the Illinois Manufacturers' Association (IMA) to document existing research and development programs and learn more about the participants' technology needs. The survey should identify those areas in which industry respondents feel additional information and assistance would be beneficial. The results from this survey will be used in deciding future goals for the Center's Research Program and technical assistance efforts.

Research Program staff have been working with HWRIC-funded researchers and painting industry representatives to examine approaches to managing paint waste. The project team was directed to:

- ♦ assess the nature and extent of waste generated from the manufacture and use of paint,
- ♦ develop cost effective options for disposal, and
- ♦ suggest ways to encourage waste reduction by the producers and users of paint and related products.

Three reports were prepared to fully document this legislatively-mandated study: *Paint Waste Reduction and Disposal Options - Executive Summary* (HWRIC report number TR-007), *Paint Waste Reduction and Disposal Options - Volume I* (RR-060), and *Paint Waste Reduction and Disposal Options - Volume II - Site Visits* (to be published in FY'93). All are available from HWRIC's Clearinghouse.

Financial support from Illinois' Environmental Protection Trust Fund will allow Research Program staff to develop instructional materials that present successful waste reduction options for the paint industry and the users of its products. Materials under development include:

- ♦ case study factsheets documenting waste reduction success stories

- ♦ paint waste reduction guides for homeowners and small businesses, and
- ♦ presentations to industry and civic groups promoting pollution prevention in painting operations.

Center staff will work with trade groups, industry representatives, and public information groups to distribute the information, selecting the most appropriate and receptive audience for each factsheet that is developed during the two-year project.

Remediation Technologies

Although today's emphasis is on reducing wastes before they are generated, the cleanup of contamination that resulted from past disposal practices of industrial and municipal wastes will still need to be addressed for many years. While cleanup progress has been made, and many sites have been successfully restored, much remains to be done. For some sites the contamination is so extensive that total remediation will most likely be impossible. The development of new technologies, or the modification or development of new uses for existing technologies that will facilitate these efforts, must be pursued and supported.

Remediation technology evaluations can require several years of experimentation at considerable expense, particularly for conducting the field validation of a technology. HWRIC has been able to contribute the financial support for the development of several techniques that can be used to destroy contaminants and make polluted areas useable again. Two long-term projects that look at remediation through photochemical methods were completed in FY'92. Dr. Richard Larson of UIUC has studied the ability of photosensitizers to destroy organic contaminants in wastewaters and polluted natural waters. In his project, *Strategies for Photochemical Treatment of Wastewaters Containing Hazardous Organic Materials*, common substances such as riboflavin and iron were studied in the presence of sunlight to determine whether they could be used to enhance the degradation of organic contaminants. It was found that these agents did facilitate the destruction of the organic materials through the generation of free radicals which effectively reduce organic materials to carbon dioxide and water. While the process does work, it has limitations and is not ideally suited for destruction of highly contaminated

wastestreams. It is more applicable as a polishing step in the remediation process for removal of the last traces of organic contaminants.

The other project that uses photochemical treatment to destroy organic contaminants in water uses a combination of hydrogen peroxide, ozone, and ultraviolet (UV) light to generate free radicals to achieve destruction of the organic materials. For five years HWRIC has supported this research project, conducted by Mr. Gary Peyton and his associates at the Illinois State Water Survey. Testing of the process began with bench scale feasibility studies, continued through development and assembly of a mobile treatment unit, and finished with the field testing of the mobile unit in FY'92. This project, entitled *Field Scale Evaluation of Aquifer and Wastewater Cleanup Using a Mobile Oxidation Pilot Plant (MOPP): Phase II*, involved the use of the photochemical treatment system housed in the mobile pilot facility to treat water contaminated with fuel. Preliminary data indicate that the method is successful in destroying the organic contaminants. The final project report (available March 1993) will describe the mobile facility and document its cleanup capabilities. This project was jointly funded by ENR's Office of Research and Planning and by the Department of Defense (field evaluation portion only).

A second field study, *A Demonstration of Hydraulic Fracturing to Facilitate Remediation*, looked at the feasibility of using this technology to improve the effectiveness of a variety of *in situ* remedial actions, such as bioremediation. Much of this work was supported by USEPA, with HWRIC assistance during the final pilot trials and field application of this technology at a site in Illinois. Evaluation of the field data is in progress. The success of the field demonstration will be highlighted in a report to be published in early 1993.

Human Health and Environmental Risks

Assessment of the risks posed by pollutants was the focus of two new projects started in FY'92. Both continue into FY'93, but some preliminary findings are available. The Agency for Toxic Substances and Disease Registry (ATSDR), in cooperation with the Illinois Department of Public Health (IDPH), is conducting a study to determine the environmental impact of exposure to lead

contamination. The ATSDR/IDPH study surveys the residents of three Illinois towns, Granite City, Madison, and Venice. These areas have documented soil lead levels as high as 10,000 parts per million (ppm) resulting from 80 years of operation of a secondary lead smelter. Lead contamination has been spread throughout the areas in surface runoff and in fugitive dust emissions from on-site soil and slag piles.

Dr. William Buck's investigation, *Household Pets as Sentinels of Lead Exposure*, will evaluate the merit of using dogs and cats from these areas to monitor environmental lead exposure to humans, particularly children. During FY'92 blood lead concentrations of the pets (dogs and cats) were measured. Correlations between lead concentrations and other blood parameters are being studied. Data from the ATSDR/IDPH study of the human population will become available in FY'93, at which time correlations between the animal and human blood lead levels will be attempted. If the researcher's hypothesis is correct, measurement of blood lead levels in pets can be used to signal potential problems in the human population. Obtaining the animal blood samples is much easier than obtaining samples from area human residents. Perhaps the resistance to undergoing blood tests to screen children for blood poisoning would lessen if parents can be shown that the high levels of lead in the pet dog or cat may mean comparable levels of lead are present in their children.

The second health-related project, *Indoor Toxic Volatile Organic Compounds Attributed to the Residential Storage of Household Hazardous Waste*, looks at the extent of contamination and the role of toxic vapors emitted from common household chemicals such as automotive products, pesticides, paints, and solvents. Indoor air quality is often worse than the quality of the air outdoors. This is the result of the products and building materials used in homes and other buildings as well as the storage of leftover or excess household products. The problem of higher concentrations of pollutants is compounded by the length of exposure since Americans typically spend about 90% of their time indoors.

The investigators will use an experimental house where ventilation and air movement can be easily monitored and controlled to develop a model that will predict concentrations of volatile organic compounds

that result from the storage of various household products. During FY'93 and '94, the model predictions will be verified with data from actual homes and normal residential storage of the items that were used in the experimental facility. Early results, which looked at benzene levels that resulted from venting a one-gallon gasoline container, documented levels of 300 parts per billion (ppb) of benzene in the storage area and 12ppb benzene in an adjacent room. While benzene at these concentrations does not pose a health risk, the cumulative effects of benzene in combination with other compounds may be a threat to good health. Risk analysis will be part of the final report for this project.

C. Program Activities During FY'92

Research Program staff worked with other Center staff and representatives from government, industry, and academia to determine the research needs of the state and to gear the project solicitation accordingly. The annual solicitation for project ideas followed the schedule provided in Table 3-2. Preproposals were requested and evaluated by Center staff. In FY'92, 76 preproposals were submitted to HWRIC. Ten were selected for submission as full proposals. External and internal reviews were used to select 6 of these 10 as FY'93 projects.

A second solicitation for projects that explored Reduction and Recycling Techniques and Technologies (RRT) was prepared and sent primarily to industries and small businesses. RRT supports the implementation and evaluation of these technologies and techniques with funds that match the industry contribution to a maximum of \$50,000. The FY'93 RRT project solicitation followed the same schedule as that for research projects (Table 3-2). Twelve proposals were submitted and three were selected for funding in FY'93.

Project management activities included meetings with the project investigators and review of quarterly progress reports. Mid-year progress meetings were used to evaluate the success of the researchers in meeting their project goals. Research Program staff also coordinated review of project deliverables, including reports, computer data and software.

Of the 33 projects funded in FY'92, 18 are now complete, with final project reports either available, in review, or in preparation.

Publications that resulted from these research activities are listed in Table 3-3. FY'92 projects that are completed with reports in preparation or review are noted in Table 3-4. The anticipated dates of availability of the final reports describing these studies are also provided in the table. Brief summaries of the FY'92 projects are included at the end of this chapter. The next edition of HWRIC's newsletter will focus on FY'92 projects and more detailed summaries of many of these projects will be provided in the FY'92 Research Program Overview.

D. Accomplishments

The HWRIC annual report for FY'91 highlighted projects that focused on important problems for the state undertaken in the first six years of the Center. During FY'92, Center-funded projects continued to address significant waste management issues of the state. The Research Program has also fostered associations with researchers from other state agencies and universities, making it possible for HWRIC to quickly respond to requests from the Governor's Office or the General Assembly. Successful cooperative efforts in FY'92 include the completion of the legislatively-mandated study of paint wastes, and the continued assistance and support of projects to resolve the waste management problems of Illinois' institutions of higher education.

Seven projects examined risks to human health and the environment. These studies included an investigation of the use of pets as indicators of human exposure to toxic metals, measurement of the quality of indoor air that results from routine storage of household hazardous substances, identification and characterization of urban sources of atmospheric pollution, quantitation of the amount of pesticides emitted from agricultural operations and the amount scavenged from the atmosphere in rainfall, measurement of toxic substances in the air above a Superfund site, and assessment of the impact of using fly ash as an additive to soil. The seventh project, *Evaluations of Methods for Tracking and Reporting the Presence of Special Waste from Commercial Sources*, will use a one-month sample of disposal practices of businesses on a commercial route to provide some indication of the amounts and types of special wastes routinely disposed in the municipal solid wastestream. Part of the project will be modification of existing bar-coding software to quantify these wastes.

Table 3-2

FY'93 Project Solicitation Schedule	
Action Item	Due Date
Preproposal Solicitation	December 1991
Preproposals Due	January 31, 1992
Preproposal Selection	March 1992
Proposals Due	May 15, 1992
Proposal Selection	July 1992
Projects Begin	October 1992

Table 3-3

FY'92 Research Reports and Technical Documents

Research Report Number Title	Author(s)	Publication Date
RR-057 Toxic Volatile Organic Chemicals in Urban Air in Illinois	Clyde W. Sweet and Stephen J. Vermette - Illinois State Water Survey	October 1991
RR-058 Optimal Time for Collective Volatile Organic Chemical Samples from Slowly Recovering Wells	Sheng-Fu J. Chou, Beverly L. Herzog, John R. Valkenburg and Robert A. Griffin - Illinois State Geological Survey	March 1992
RR-059 Generation and Management of Hazardous Waste in Illinois During 1986	John L. Warren, Sandra Curtis-Powell, Christine D. Ellestad and Rachel E. Baker - Center for Economics Research	June 1992
RR-060 Paint Waste Reduction and Disposal Options - Volume 1	Center for Economics Research - Research Triangle Institute	June 1992
TR-003 X*TRAX™ Laboratory Treatability Study of Jet Fuel Contaminated Soil from Chanute Air Force Base Near Rantoul, Illinois	Peter G. Romzick and Carl Swanstrom - Chemical Waste Management, Inc.	November 1991
TR-004 The Feasibility of Reclaiming Shell Material from Investment Castings	Timothy M. Peters - University of Missouri-Rolla, and Daniel L. Twarog - American Foundrymen's Society	January 1992
TR-005 Removal and Recovery of Carbon Disulfide Emitted by the Viscose Process	Michael J. McIntosh - Argonne National Laboratory	December 1991
TR-006 Applications of Supercritical Fluid Processing to Environmental Control	Charles A. Eckert, Gregory W. Leman and David L. Tomasko - University of Illinois	December 1991
TR-007 Paint Waste Reduction and Disposal Options - Executive Summary	Center for Economics Research - Research Triangle Institute	June 1992

Table 3-4

Research Projects Completed in FY'92

Title	Principal Investigator/ Affiliation	Date Report Available
Waste Paint Reduction and Disposal Options Study, Volume I	Warren & Baker/ Research Triangle Institute	September 92
Waste Paint Reduction and Disposal Options Study, Volume II: Site Visits	Slwinski/ Research Associates	January 93
LUST Cleanup Technology Report	Perino/Perino Technical Service, Inc.	January 93
Biological Treatment of Wastewaters Containing Hazardous Organic Compounds	Rittmann/ University of IL @ Urbana-Champaign	January 93
Field Study of Transit Time Through Compacted Clays	Cartwright/ IL State Geological Survey	January 93
Cold Season Background Air Monitoring at Crab Orchard Wildlife Refuge	Vermette & Williams/ IL State Water Survey	February 93
Evaluation of Organic Compound Contamination in Soils and Aquifer Solids	Caughey/ IL State Water Survey	February 93
Determination, Implementation, and Evaluation of Laboratory Waste Minimization Opportunities	Ashbrook/ University of IL @ Urbana-Champaign	February 93
Brine Utilization Research	DeSchepper/Lonza, Inc.	February 93
A Demonstration of Hydraulic Fracturing to Facilitate Remediation	Murdoch/ University of Cincinnati	February 93
Hazardous Waste Reduction: An Integrated Approach to Alternative Technologies	Graham/ Graham Plating Co.	February 93
Strategies for Photochemical Treatment of Wastewaters Containing Hazardous Organic Materials	Larson/ University of IL @ Urbana-Champaign	March 93
Characteristics of Atmospheric Sources of Toxic Volatile Organics	Scheff/ University of IL @ Chicago	March 93
Atmospheric Emission and Deposition of Agricultural Pesticides	Williams & Sweet/ IL State Water Survey	March 93
Field Scale Evaluation of Aquifer and Wastewater Cleanup Using a Mobile Oxidation Pilot Plant (MOPP): Phase II	Peyton/ IL State Water Survey	March 93
Improvements in the Solidification of Hazardous Inorganic Wastes by Silica Fume (Microsilica) Concrete	Bayasi & Fuessle/ Bradley University	March 93
Development of a Traveling Exhibit to Enhance the Visibility of HWRIC	Schlitt/Nature of Illinois Foundation	NA*
Toxicity Characteristic Leachability Procedures (TCLP) Analysis of Pesticide	Goetsch/Illinois Department of Agriculture	NA*

*NA - Not applicable; project will not result in published report

Examination of technologies to treat existing contamination problems was the subject of nine projects. The technologies studied included bioremediation, hydraulic fracturing, photochemical oxidation, stabilization/solidification, and landfarming. One project, *LUST Cleanup Technology Report*, will describe all of the methods that have been approved by the Illinois Environmental Protection Agency (IEPA) as suitable for the remediation of contamination created by leaking underground storage tanks (LUSTs). The time needed for remediation by the selected methods, the effectiveness of each method, and the cost of the cleanup, will all be detailed.

Most of the remaining FY'92 projects focused on pollution prevention. Source reduction was fostered through computerized tracking of raw materials and wastes. Process modification to recover and recycle wastes were successfully evaluated for one electroplating process. Methods for reducing paint related wastes from manufacture and use were suggested. Ways in which HWRIC programs can assist in the adoption of pollution prevention concepts were identified.

E. Plans for FY'93

A reduced research budget has slowed the Center's progress in understanding Illinois' waste problems and in finding solutions. However, Research Program staff will continue to solicit ideas in priority research areas where return on the research dollar will be maximized. The surveys of schools and industry will be completed during FY'93. Data from these surveys will identify areas where HWRIC can provide direct technical assistance, including technology evaluations. The Research Program will also continue to fund pollution prevention research. The usefulness of the computerized tracking system of chemicals and wastes, developed in an FY'92 research project, will be evaluated during FY'93. New projects with industry will test waste reduction efforts, particularly parts cleaning, at automotive products and outboard motor manufacturing facilities, and will develop a process for recovering oil from refinery waste sludges. These projects are described in more detail in Chapter 6.

One of HWRIC's long-term strategies is to work with institutions of higher learning to raise students' level of knowledge and awareness

of pollution prevention issues. In support of this strategy, HWRIC will fund two new projects to develop pollution prevention curricula for use in engineering programs and by schools of business and public health. These courses will introduce students to the concepts and benefits of pollution prevention that they can carry into the business environment after graduation.

Continued evaluations of treatment technologies are planned for FY'93. Landfarming and bioremediation will be tested for their effectiveness in treating pesticide contamination. The use of bioremediation for treatment of contamination from former manufactured gas plant sites will also be explored. The advantages and limitations of these methods will be included in the final project reports.

A report will be prepared to describe the evolution of industrial waste management practices from 1900 to 1970. It will focus on historical activities in Illinois, but relevant information from areas of contamination in other states will be discussed. The report will include information on the types of contamination problems that resulted from past industrial practices and the effects that public disclosure of these problems had on the development of current waste management regulations. If documentation of successful site remediations is found, it will be included in the report.

Further assessments of health and environmental risks posed by toxic substances will be made through continued study of indoor air quality, examination of the relationship between the levels of toxic substances in the blood of humans and their pets, evaluation of the long term effects of using fly ash as a soil supplement, and development of bioassays to determine the health hazards of contaminated air and soil.

Fifteen projects begun in FY'92 will continue in FY'93. Thirteen new projects will be initiated in FY'93. Of these 28 total projects, 19 are scheduled to be completed by the end of FY'93 and 9 will continue into FY'94. Table 3-5 lists the FY'92 projects that will continue into FY'93. New projects scheduled to be supported by HWRIC during FY'93 are listed in Table 3-6.

Identification and promotion of new and improved waste treatment and pollution prevention technologies continues to be an

Table 3-5

FY'92 Projects Continuing in FY'93

Title	Principal Investigator/ Affiliation	Project Duration (years)
Characterization and Assessment		
Measurements of Indoor Toxic VOC Concentrations Attributed to the Residential Storage of Household Hazardous Waste	Sweet & Vermette/ IL State Water Survey	2
Environmental Processes and Effects		
Speciation and Mobilization of Toxic Heavy Metal Ions by Methanogenic Bacteria	Niederhoffer & Koropchak/ Southern IL University @ Carbondale	1.5
Impact of Fly Ash Disposal on Plant Development	Rayburn/University of IL @ Urbana-Champaign	3
Treatment, Disposal and Remediation		
Recovery and Recycle of Metals from Industrial Wastewater by Adsorption on Fe-coated Carbon	Anderson/ IL Institute of Technology	1.5
An Investigation of Column Flotation Technologies for the Pretreatment and Volume Reduction of Fine Contaminated Soils and Sediments	FitzPatrick/ Northwestern University	2
Use of Landfarming to Remediate Soil Contaminated with Pesticide Wastes	Felsot & Frank/ IL Natural History Survey and Environmental Engineering	1
Evaluation of Methods for Tracking and Reporting the Presence of Special Waste from Commercial Sources	Freeman/Solar Environmental Services, Inc.	.5
Enhancement of the Degradative Potential of Microbial Isolates Enriched from Herbicide Contaminated Soil	Felsot, Dzantor & Vossbrink/ IL Natural History Survey	2
Waste Reduction		
Stabilization of Arsenic Nonwastewaters	Fuessle & Taylor/ Bradley University	1.5
Categorizing Major Waste Streams in Foundries	Twarog/ American Foundrymen's Society, Inc.	2
Development and Pilot Demonstration of a Computerized Bar-Code Based Waste Tracking System for Waste Minimization at Argonne National Laboratory	Peters/ Argonne National Laboratory	1.5

Table 3-5 cont'd

Title	Principal Investigator/ Affiliation	Project Duration (years)
Waste Management Survey of Illinois Higher Education Institutions	O'Rourke/ Survey Research Laboratory	1.5
Technology Transfer to Aid Pollution Prevention and Waste Management	Lakner/ Survey Research Laboratory	1.5
Use of Char for Management of Paint Processing Waste	Kruse/Illinois State Geological Survey	1
Risk Assessment and Policy Analysis		
Household Pets as Sentinels of Lead Exposure	Buck/ University of IL @ Urbana-Champaign	2

important program goal. Improving environmental quality hinges on identifying long-term research needs and obtaining funding to support projects that will address those needs. Ten areas where more research was needed were identified in FY'91 (see HWRIC FY'91 Annual Report). FY'92 projects have provided some data on these critical issues. Projects planned for FY'93 will continue that trend.

Additional work in the American Bottomlands area (near St. Louis) to quantify contamination, promote pollution prevention, and assess health risks was in part realized. The project proposing pets as sentinels for human risk, when combined with the much larger ATSDR study, adds to the knowledge base regarding the risks that can exist from heavy metal contamination that is probable in highly industrialized areas. But community education is still needed in these areas so residents can know how to eliminate, or at least reduce, the health risk these contaminants pose. A pollution prevention strategy will be initiated in the area in FY'93. Center researchers will work with a Granite City automotive products facility to reduce the amount of waste generated (see Chapter 6). A great deal still needs to be done to address the contaminant problems in this area that historically has supported heavy industry.

Monitoring the effectiveness of remediation efforts was HWRIC's long term goal for the Crab Orchard area. This goal may not be achievable due to reductions in program funding. The extent of the contamination in soil,

water, air, and much of the animal population has been documented by HWRIC-sponsored research. Cleanup of the most highly contaminated area is scheduled for October 1992. However, the reduced program budget for FY'93, and prior commitments of the funds that are available, will mean that contaminant assessment during the beginning stages of the cleanup activities will not be possible. With additional research funding there would be an opportunity to monitor the later stages of the cleanup and to assess the long-term effect of contamination on the animal population.

Field demonstrations of two treatment technologies were completed in FY'92 and two others will be explored in FY'93. Soil/groundwater remediation technologies are being investigated. Development and demonstration of technologies to reduce emissions of air toxics, plus assistance on compliance with the Clean Air Act, have both been addressed to a limited extent. Pursuit of new technologies and new uses for existing technologies typically requires considerable financial commitment. Progress will be slow until additional funding is obtained.

Expansion of HWRIC's Pollution Prevention Program technology development has progressed to a limited extent. New uses for existing technologies have been tried with success and are now being used to achieve waste reduction. One case involves a new use of ultrafiltration technology (see Chapter 6). Additional evaluations of ultrafiltration for other

Table 3-6

New FY'93 Research Projects

Title of Project	PI/Affiliation	Duration of Project (Yrs.)
Risk Assessment		
Determination of Animal Hazards from PCB-Contaminated Air and Soil Samples from Crab Orchard Using Planarian and Rat Bioassay Systems	Hansen/University of Illinois	2
Characterization and Assessment		
Historical Context of Hazardous Waste Management	Colten/Illinois State Museum	1
Treatment, Disposal and Remediation		
Identifying Site-Specific Limitations to Successful <i>In Situ</i> Bioremediation of Agrichemical Retail Sites	Cole/University of Illinois	2
Biological Treatment of a Manufactured Gas Plant Site Soil	Pedersen/Remediation Technologies, Inc.	.8
Waste Reduction		
Pollution Prevention and Total Quality Management: Curricula for Schools of Business and Public Health	Bierma/Illinois State University	1
Pollution Prevention Course at the Illinois Institute of Technology	Noll/Illinois Institute of Technology	1
Waste Reduction at an Automotive Products Manufacturing Facility	A.O. Smith Corporation Granite City	1
Waste Reduction at an Outboard Motor Manufacturing Facility	Outboard Marine Corporation Waukegan	1
Process Development for Treating Refinery Waste Sludges and Recovering Oil	US Emulsion Technologies, Inc. West Chicago	1

purposes will continue. As part of that expansion, a Graduate Research Assistant program has been established. Student assistants (one or two per semester) have been hired to assist with technology evaluations and to participate in treatability studies and in-plant assessments. Participants receive valuable practical experience.

Wastestream characterization is being performed. A project team is working with the foundry industry to clearly characterize its wastes and to demonstrate the advantages of maintaining segregated wastestreams to facilitate the use of recovery and reuse technologies. Characterizations of six major wastestreams found in research and teaching laboratories, and the documentation of methods to reduce and/or

reuse these wastes, was achieved during FY'92. More work in this area is needed in the development and promotion of pollution prevention alternatives for laboratories.

Development of bioassays has been supported by HWRIC in the past and will again be funded in FY'93. These assays provide a simple, cost-effective way to determine environmental damage.

These areas represented long-term goals for the Research Program, and success in all areas in a single year was not expected. But funding reductions in FY'92 and those proposed for FY'93 will reduce even further the slow rate of progress HWRIC has made in meeting these goals. Research Program staff continue to seek

the support of other state and federal agencies to supplement the limited funds available for research activities. Identification and promotion of new, improved waste management options continues to be a program goal.

More than ever before, state support of research is essential. Research funds support efforts that ultimately result in significant environmental benefits. Support for pollution prevention technology development generally results in:

- ♦ improved production,
- ♦ reduced raw material usage,
- ♦ increased profits, and
- ♦ new jobs.

Research is the key to the state's long-term efforts to enhance industrial productivity, to restore areas made unusable by contamination, to reduce health risks to Illinois citizens, and ultimately, to improve the environment.

Research Projects Completed in FY'92

Waste Paint Reduction and Disposal Options Studies, Volume 1. John Warren and Rachel Baker, Research Triangle Institute

This legislatively-mandated project is designed to develop cost effective, environmentally sound, and technically feasible paint disposal options for small businesses. A literature search and a mail survey: 1) identified the types and quantities of paint waste generated in Illinois; 2) determined the characteristics of those paint wastes and what operations result in their generation; and 3) determined what procedures are used for waste paint reduction and management options. The study documents cost-effective alternatives for waste paint reduction and management, and develops recommendations for legislation, regulation, and a public education program to reduce the waste paint problem in Illinois. This study was conducted in cooperation with the project by Research Associates.

Waste Paint Reduction and Disposal Options Studies, Volume II Site Visits. Benjamin Sliwinski, Research Associates

This section of the legislatively-mandated waste paint study evaluates current waste paint reduction, disposal, and management methods available to Illinois businesses and households, and identifies additional waste paint reduction alternatives and management options. Visits have been made to 12 facilities that manufacture, use and recycle paints to identify effective waste reduction techniques. The final report details: the types and quantities of paint wastes generated through paint manufacture and use in Illinois; paint waste reduction options which can be implemented in Illinois; and an educational program aimed at enhancing the implementation of paint waste reduction policies. This was conducted in cooperation with the project by Research Triangle Institute.

LUST Cleanup Technology Report. Janice Perino, Perino Technical Services, Inc.

The problem of remediation of contamination resulting from leaks in underground storage tanks is one that will be faced for many years. Currently the state has a financial assistance plan for cleanup, but does not have a document detailing available

remediation technologies to help in selecting the most appropriate method. The investigators will prepare a document describing LUST cleanup technologies in sufficient detail to allow owners and consultants to make informed selections of the best corrective action technologies. The researchers will investigate soil and water remediation using: Illinois EPA records that document past cleanup efforts, a literature review, and information available through vendors and experts in the field. The document will be available from HWRIC in January 1993.

Cold Season Background Air Monitoring at Crab Orchard Wildlife Refuge. Stephen Vermette and Allen Williams, Illinois State Water Survey

Emissions of airborne contaminants may result from particulate suspension during materials handling and as the result of incineration or other remediation efforts, causing concern about human exposure to contaminants. The researchers will provide background levels of specific contaminants and investigate the impact of remediation activities on airborne particulate toxicity levels. Continued monitoring is planned during site remediation which is scheduled for October 1992. The report on the background concentrations will be available in February 1993.

Evaluation of Organic Compound Contamination in Soils and Aquifer Solids. Michael Caughey, Illinois State Water Survey

The objective of this project is to characterize the organic matter content in both clean and contaminated aquifer solids by adapting and applying supercritical fluid extraction and other routine analytical and geochemical methods for use in the analysis. The resulting data will help predict the fate of subsurface contaminants. New, more reliable analytical methods will make it increasingly possible to assess the level of contamination and the effectiveness of remediation processes. A final report will be available in February 1993.

Biological Treatment of Wastewaters Containing Hazardous Organic Compounds. Bruce Rittmann, University of Illinois at Urbana-Champaign

Several volatile organic compounds found in sewage, industrial wastewaters, and

landfill leachates are being studied to understand their biotransformation to less toxic compounds and to examine an innovative approach for enhancing biological treatment using reductive dechlorination. If successful, the project will result in significant improvements to standard biological treatment methods for certain wastes. A final report will be available in January 1993.

Field Study of Transit Time Through Compacted Clays. Keros Cartwright, Illinois State Geological Survey

This long-term project is determining transit times for water and tracer movement through a full-scale soil liner. Tracers are used to indicate the speed of movement of contaminants through the liner. For this project tracers included tritium and bromine. Field data are being used to test the accuracy of the methods and the models used to predict transit times, and to ascertain the overall performance of the clay liner. A final report of this 5-year study will be published in January 1993.

Strategies for Photochemical Treatment of Wastewaters Containing Hazardous Organic Materials. Richard Larson, University of Illinois at Urbana-Champaign

The investigators are studying the effectiveness of photosensitizers for treatment of waters polluted with a variety of common organic contaminants. If this technique proves successful, it would be the basis for a relatively inexpensive water treatment process. Several wastes will be used to test the ability of the photosensitizer to treat or decompose the contaminants. The final report will be available in March 1993.

Determination, Implementation, and Evaluation of Laboratory Waste Minimization Opportunities. Peter Ashbrook, University of Illinois at Urbana-Champaign

The goal of this project is to develop useful waste minimization guidance materials for laboratories based on results that have been achieved at the University of Illinois. This study will identify, implement, and evaluate methods that will reduce or eliminate the generation of chemical waste in laboratories. Information will be gathered through surveys and documented case studies with special emphasis on the use of solvents, acids, and mercury. In addition to the

guidance document, the researchers will develop a generic waste minimization plan and a computerized waste minimization audit. This project is scheduled for completion in February 1993.

Brine Utilization Research. Mark DeSchepper, Lonza

This research project addresses the problem of amine-contaminated brine disposal. Three areas of study are being addressed: end uses, processing requirements, and purifying requirements. The report will focus on the crystallization and electrohydrolysis options of processing, disposing of the brine "as is," and exploring the possibility of purification. A final report will be available in February 1993.

Characteristics of Atmospheric Sources of Toxic Volatile Organics. Peter Scheff, University of Illinois at Chicago

A source-receptor dispersion model has been developed using data collected from the measurement of atmospheric pollutants from known sources. The model follows the progression of the pollutants through a limited space. This continuing project will further refine the model and test its results with data from coke plants, an incinerator, a landfill, and commercial garages in Chicago. The final report will be available in March 1993.

Atmospheric Emission and Deposition of Agricultural Pesticides. Allen Williams and Clyde Sweet, Illinois State Water Survey

This project is designed to determine the magnitude of pesticide fluxes from agricultural fields into the atmosphere and the magnitude of return fluxes by wet and dry deposition. This project will: 1) determine the seasonal ambient background levels of several pesticides in Illinois; 2) measure the corresponding pesticide concentrations in rainwater; 3) determine the partitioning of the ambient pesticide(s) into volatile and atmospheric aerosol components; 4) measure the emission and dry deposition velocities of two pesticides; and 5) measure the concentrations of the two pesticides over an experimental field under normal farm activity. The results will indicate the potential risk that these pesticides may pose to human health and the environment. The final project report will be available in March 1993.

Field Scale Evaluation of Aquifer and Wastewater Cleanup Using a Mobile Oxidation Pilot Plant (MOPP): Phase II. Gary Peyton, Illinois State Water Survey

Phase I of this project was the assembly and initial testing of the mobile unit. Phase II continues the testing of the equipment using contaminated samples obtained from sites in Illinois. In the winter of 1990, the unit was moved to a site to field test its waste treatment capabilities. The final report, including an evaluation of the costs and effectiveness of this technology in the field, will be available in March 1993.

Improvements in the Solidification of Hazardous Inorganic Wastes by Silica Fume (Microsilica) Concrete. Ziad Bayasi and Robert Fuessle, Bradley University

Solidification is an accepted treatment method for hazardous wastes that must be treated prior to landfilling. Silica fume, a common manufacturing by-product, appears to be a promising admixture that improves the stabilizing features of this method. This project seeks to document this improvement and compare the use of silica fume to other additives for treating metal-containing wastewaters and sludges. Documentation of the success of this treatment method will be available as a final project report to be published in March 1993.

A Demonstration of Hydraulic Fracturing to Facilitate Remediation: Phase II. Lawrence Murdoch, University of Cincinnati

This project supports activities related to the creation and assessment of the effectiveness of hydraulic fractures for remediation of contaminated soils and groundwater. Field work evaluating the effect of hydraulic fracturing on the rate of recovery of contaminants during a pilot-scale remedial effort is being conducted at a site in DuPage County. The results of that test will be available in a final report in February 1993.

Hazardous Waste Reduction: An Integrated Approach to Alternative Technologies. Clayton Graham, Graham Plating

This plating company is working to move to a new facility which has been designed to produce neither sludge nor wastewater. All

plating chemicals will be recovered and reused. HWRIC will evaluate the technical feasibility and cost effectiveness of the main waste reduction system which is a vacuum evaporation unit. The study is designed to compare the new plant operations to the old in terms of product quality, amounts of waste produced and operating costs. Project results will be made available to other electroplaters in the state. The final report is expected to be published in February 1993.

Development of a Traveling Exhibit to Enhance the Visibility of HWRIC. John Schmitt, The Nature of Illinois Foundation

The mission of The Nature of Illinois Foundation is to foster an understanding of and appreciation for the natural resources of Illinois and to promote the activities of the three scientific Surveys and HWRIC. An exhibit will be designed to stress the importance of state science and the work of the Surveys and the Center. It will highlight the Geographic Information System as a tool for making decisions. This system can supply regional scientific data for all of Illinois. These data have resulted from research conducted by Survey and Center scientists. It also includes verified regulatory information. A description of the final design of the exhibit and the types of educational materials to be printed will be completed in Fall 1992. No report will be prepared.

Toxicity Characteristic Leachability Procedure (TCLP) Analysis of Pesticide. Warren Goetsch, Illinois Department of Agriculture

In response to the 1990 amendments to the Illinois Pesticide Act, the Department of Agriculture has embarked on a study to assess the extent of pesticide contamination at retail pesticide storage, mixing and loading sites. The project will define contamination and determine the appropriate assessment and remediation techniques to implement. Samples will be selected for TCLP analyses from the most contaminated of 19 sites being investigated. Findings and recommendations are anticipated early in 1993.

FY'92 Projects Continuing in FY'93

Measurements of Indoor Toxic VOC Concentrations Attributed to the Residential Storage of Household Hazardous Waste. Clyde Sweet and Stephen Vermette, Illinois State Water Survey; and William Rose, University of Illinois Building Research Council

Indoor air quality is often worse than outdoor air quality. This problem is attributed to the numerous products and building materials used in residential and commercial buildings. The problem of higher concentrations of pollutants indoors is compounded by the length of exposure – Americans spend about 90% of their time indoors. The storage of leftover or excess household hazardous waste within a home may contribute to the deterioration of indoor air quality. The purpose of this study is to examine the extent of contamination and the effect of toxic vapors emitted from common household chemicals, such as automotive products, pesticides, paints, and solvents. Many of these materials contain benzene, carbon tetrachloride, methylene chloride, and other volatile organic compounds (VOCs). VOC levels will be measured in an experimental home, and later in occupied homes. The project continues into FY'94 with a final report anticipated in January 1994.

Speciation and Mobilization of Toxic Heavy Metal Ions by Methanogenic Bacteria. Eric Niederhoffer and John Koropchak, Southern Illinois University at Carbondale

Investigators are examining toxic heavy metal contamination at Crab Orchard National Wildlife Refuge by studying the activity of methane-producing bacteria. Methanogenic bacteria synthesize methane from hydrogen and carbon dioxide. They are responsible for 80% to 90% of the biogenic methane found in the atmosphere. This is a one-year project that focuses on the importance of methanogens for mobilizing cadmium, lead, and mercury in the environment. Studies underway address the growth of these bacteria in the presence of these metals and the capability of sequestering agents, cell wall components, and intracellular proteins to solubilize iron from a variety of phases. The project final report will be available in July 1993.

Impact of Fly Ash Disposal on Plant Development. A. Lane Rayburn, University of Illinois at Urbana-Champaign

The purpose of this project is to determine the effect of fly ash disposal on plant development. As utilities continue to burn coal to produce electricity, vast amounts of fly ash are being produced as a waste by product. Studies have indicated that use of fly ash in strip mine reclamation and agriculture land amendment would help alleviate problems associated with landfill disposal of fly ash; however, little information exists regarding the long-term subtle effects that such uses could produce. Long-term exposure to levels of toxic chemicals (like those in fly ash) too low to induce toxicity may have subtle effects on the genetic material contained within the plant nucleus. This study will examine nuclear DNA and cell cycle parameters in corn to quantify the subtle effects of fly ash on plant development. This is a three-year project that is scheduled for completion in June 1995.

Recovery and Recycle of Metals from Industrial Wastewater by Adsorption on Fe-Coated Carbon. Paul Anderson, Illinois Institute of Technology

Dr. Anderson will evaluate an iron oxide-coated carbon adsorption process for the removal and recovery of metals from industrial wastewaters. The study will: 1) evaluate the coating process and characterize the adsorbent; 2) determine adsorption characteristics of the solid compared to several model adsorbates; 3) determine the operating parameters for a column adsorption process; and 4) compare the composite adsorbent to a traditional ion exchange process. This project will be completed in March 1993.

An Investigation of Column Flotation Technologies for the Pretreatment and Volume Reduction of Contaminated Soils and Sediments. Joseph FitzPatrick, Northwestern University

Soils may be contaminated by improper waste disposal, leaking underground storage tanks, accidental chemical releases, and runoff from industrial, agricultural, or disposal areas. Treatment technologies for contaminated

sediments include stabilization, vapor extraction, bioremediation, solvent extraction, soil washing, and vitrification. Remediation processes are often integrated to achieve effective treatment. This adds to the time, effort, and cost of remediation. This project will investigate a column flotation technology that could separate the fine fractions of low- to moderately-contaminated soils and sediments from cleaner ones, effectively reducing the volume of soil requiring further treatment. This would reduce the time and cost of remediation. This project began March 1992 and continues into 1994.

Use of Landfarming to Remediate Soil Contaminated with Pesticide Waste. Alan Felsot, Illinois Natural History Survey and James F. Frank, Andrews Environmental Engineering

Soils contaminated with pesticide waste at agricultural retail facilities in Illinois need immediate cleanup to prevent further degradation of water quality and pollution of nearby residential property. Remediation of the soil by landfarming may provide an economical and effective solution. Project objectives are to: 1) remediate pesticide waste by excavating contaminated soil and landfarming it on cropland; 2) determine effects of loading rates on the degradation of landfarmed pesticides; 3) determine the effects of biostimulation with organic nutrient amendments on landfarmed pesticides; 4) determine the effects of landfarming on the quality of surface runoff and shallow ground water; 5) assess toxicity of waste-treated soils, runoff, and leachate; and 6) develop environmentally sound technical criteria for landfarming of pesticide-contaminated soils. A report will be available in June 1993.

Evaluation of Methods for Tracking and Reporting the Presence of Special Waste from Commercial Sources. Judith Freeman, Solar Environmental Services, Inc.

An unspecified amount of special waste is being disposed in municipal and commercial solid waste streams and landfilled. It is not easy to quantify these materials because of difficulty in differentiating special waste by quick visual inspection. This project will examine the use of bar code technology to track special wastes in mixed solid waste loads and pilot a field application of the technology on established commercial routes. This project is scheduled for completion in October 1992.

Enhancement of the Degradative Potential of Microbial Isolates Enriched from Herbicide-Contaminated Soil. Alan Felsot and Charles Vossbrink, Illinois Natural History Survey; E. Kudjo Dzantor, Tennessee Valley Authority

Several strategies have been used for the development of microbial decontamination of high-levels of herbicides in soil. While some success has been achieved with microbial decontamination of liquid wastestreams, decontamination of soil has been more difficult. To develop a microbial-based technology that is suitable for decontamination of pesticide waste, researchers are enhancing the degradative abilities of several microbial strains isolated from herbicide-contaminated soil. Those cultured strains can then be used to aid clean-up of herbicide contaminated soil resulting from spills and rinsing procedures. The final project report will be available in January 1993.

Stabilization of Arsenic Nonwastewaters. Robert Fuessle and Max Taylor, Bradley University

The 1984 Hazardous and Solid Waste Amendments to RCRA required USEPA to promulgate regulations for treating hazardous wastes before land disposal. USEPA has declared vitrification the best demonstrated available technology (BDAT) for arsenic-containing wastes because it effectively treats a variety of these wastes. Given the limitations of vitrification, i.e., it is energy intensive and creates potential air quality concerns, stabilization may be a desirable alternative treatment for arsenic wastes. The goal of this research is to develop a stabilization process that will treat arsenic nonwastewaters in a cost-effective and volume-efficient manner. Investigators will study: arsenic speciation in waste; a mix and design matrix with a stabilizing agent; and deterioration of the stabilized cement product. An economic analysis of the best stabilization procedure will also be made. This project is scheduled for completion in July 1993.

Categorizing Major Wastestreams in Foundries. Daniel Twarog, American Foundrymen's Society, Inc.

The project's purpose is to characterize foundry wastestreams that result in air emissions. Organic compounds are emitted during core-making, pouring, and shake-out, while inorganic compounds are emitted from

furnace melting operations. A literature review is being completed, and a database is being compiled of foundry contacts, Material Safety Data Sheets, and process operating parameters. The project will identify technologies to treat, recycle, or dispose of the identified wastes. The ultimate objective is to provide data to support the industry position in negotiating standards for emission of compounds listed by USEPA in the Clean Air Act Amendments. This work will be completed in June 1993.

Development and Pilot Demonstration of a Computerized Bar-Code Based Waste Tracking System for Waste Minimization at Argonne National Laboratory. Robert Peters, Argonne National Laboratory

This project combines the use of process waste assessments with a bar-code-based waste tracking system. It will identify significant areas for waste reduction at Argonne National Laboratory (ANL). The development and implementation of a computerized bar-code waste tracking system will enable ANL to track Argonne's hazardous wastes and will facilitate the waste chain-of-custody from the point of generation to ultimate disposal. ANL's Energy Systems Division has been selected for a pilot demonstration of the system. The report detailing the effectiveness of the system will be available in June 1993.

Automated Database Tracking of Chemical Usage at the University of Illinois at Urbana-Champaign (UIUC). John Abelson and Jerry Fisk, University of Illinois at Urbana-Champaign

This project will develop and implement a prototype computer database system to track the inflow, inventory and disposal of chemicals in research laboratories at UIUC. A personal computer will be used to log in all substances entering a laboratory allowing chemical users to search the database of available chemicals. This system will facilitate waste minimization through: 1) the reduction in duplicate and excessive purchasing of laboratory chemicals; 2) the internal recycling of unused chemicals, and 3) the fostering of improved waste disposal practices within the department. Results of the study should lead to more efficient use of chemicals and less waste chemicals being generated. The computerized tracking system will be made available to other universities in Illinois. A report will be available in June 1993.

Waste Management Survey of Illinois Higher Education Institutions. Diane O'Rourke, University of Illinois at Chicago

The objective of this project is to conduct a survey of waste management policies and practices of Illinois institutions of higher education. Participants will be asked to respond to questions regarding the personnel responsible for solid/hazardous/other waste management on each campus, and the structure under which those persons perform their duties. In addition, the survey will gather detailed information about the institutions, their waste management programs and generation sources, and their need for assistance. This project is scheduled for completion in June 1993.

Technology Transfer to Aid Pollution Prevention and Waste Management. Edward Lakner, University of Illinois at Chicago

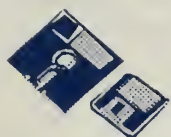
A survey of manufacturing firms in Illinois will be conducted to determine their research and information needs related to pollution prevention and to gather information about the application of waste reduction technologies in Illinois. The survey results will assist HWRIC in translating available technology into specific applications for manufacturers. Survey data and a report will be available in June 1993.

Use of Char for Management of Paint Processing Waste. Carl Kruse, Illinois State Geological Survey

This project is a cooperative undertaking between the Illinois State Geological Survey (ISGS) and Ford Motor Company that originated from a mutual interest in carbon materials which adsorb or absorb organic molecules from air and/or water. Ford Motor Company is interested in controlling emissions from painting operations and is working to develop an alternative to burial or incineration for paint sludge and particulate volatile organic compounds removed from air and water in overspray operations. The ISGS has made high surface-area carbon material from coal char with both sorptive and catalytic properties that will be tested. Paint sludge char, and mixtures of the two chars will also be tested. The project is scheduled for completion in early 1993.

Household Pets as Sentinels of Lead Exposure.
William Buck, University of Illinois at Urbana-
Champaign

The purpose of this study is to evaluate the merits of using dogs and cats as monitors of environmental lead exposure to humans. This research is being conducted at the site of a former lead smelter (NL Industries/Taracorp) in Granite City, in conjunction with a national study of the environmental impact of lead on human health. Data collected to date have shown no statistically significant effect of lead concentrations on the blood parameters examined in the dogs and cats. However, the data have shown some interesting relationships between blood lead concentrations and blood serum that may clarify mechanisms for known side effects of chronic lead exposure. Correlations between human health data and pet data will be included in the FY'93 portion of the project and in the final report. The project final report will be available in July 1993.



Chapter 4. Data Management Program

A. Introduction

Table 4-1

Conducting hazardous waste research and providing assistance to industry requires current information on the locations, quantities, properties, and components of hazardous materials and waste management facilities. The management and analysis of this information requires the use of computers and computer databases. The speed and flexibility of the computer permits rapid retrieval of selected information, regular updates and upgrades of the data. Complex integrations and analyses of multiple data files also requires the power of a computer. These capabilities are crucial to providing the best information available to those trying to understand and address Illinois' hazardous waste issues.

The HWRIC Data Management Program (DMP) is designed to serve both the research and information missions of the Center as well as the hazardous waste data needs of others in Illinois. This task is accomplished by gathering data from various sources, processing it into an integrated file structure, analyzing it, and making the results available through various reports and by direct access. In addition, as part of the Illinois Geographic Information System (IGIS) within ENR, Data Management staff provide access to many other data resources in the state.

The objectives of the program and the types of tasks being undertaken to accomplish them are listed in Table 4-1. The two main objectives of the Data Management Program are to develop a hazardous waste database for Illinois (including data acquisition, documentation, integration, and verification) and to apply the database information to environmental issues in Illinois. Program staff also provide support for the Center's electronic data processing needs. This support includes software and hardware evaluation, administration of the Center's local area network (LAN) and staff training.

The hazardous waste database is used to identify hazardous waste sites at or near properties that are being sold. The mapping

FY'93 Objectives for Data Management Program	
Develop a Hazardous Waste Database for Illinois	
<ul style="list-style-type: none"> Obtain waste management data files from government agencies and publications Obtain current information on toxicity and environmental effects of wastes and constituents Geocode locations of waste sites and activities Obtain environmental information on relationships between waste sites and affected media (air, land and water) 	
Use Database to Address Hazardous Waste Issues	
<ul style="list-style-type: none"> Assess the amounts and types of waste generated, treated, stored and disposed of in Illinois Provide data to state and local agencies, decision-makers, industry and citizens Project trends of waste generation by type and amount from manufacturing activity indicators Identify potential environmental and health risks from predicted exposure to toxic chemicals Provide detailed information on the chemical properties, disposal methods, safety and regulatory status of specific wastes Produce maps of waste activities and related environmental factors using GIS software 	
HWRIC EDP Support	
<ul style="list-style-type: none"> Evaluate and advise on selection of hardware and software Help maintain hardware and provide software user support Specialized programming for accounting, personnel, bibliographic and other applications 	

capabilities of the database are used to assess relationships between potential sources of toxic releases and known areas of contamination so the likely sources can be identified. The database has also been used to develop the "Degree-of-Hazard" categorization scheme to declassify non-RCRA (Resource Conservation and Recovery Act - USEPA) special wastes according to their potential hazards. Also, the database has been used to define and characterize various hazardous waste activities so better policies can be developed to manage those wastes.

B. The Hazardous Waste Database

Two closely related program objectives of the DMP are the development and application of a hazardous waste database. To date, HWRIC's DMP has obtained 17 types of hazardous waste-related files from about 7 sources and projects. Most of these data exist as a result of legal mandates to state and federal agencies (IEPA and USEPA in particular) to monitor, regulate and study hazardous waste activities. Data have also been obtained through research conducted or sponsored by the Center. Table 4-2 summarizes the sources and contents of these files.

Some of the most frequently used databases include the Inventory of Landbased Disposal Sites, IEPA's Comprehensive Inventory, and the Comprehensive Environmental Response, Compensation and Liability Act Information System (CERCLIS).

The Inventory of Landbased Disposal Sites includes all documented (since about 1900) land disposal sites in Illinois. The inventory lists landfills, illegal dumps, disposal surface impoundments and land application sites found throughout the state. It was compiled from a number of different sources including IEPA, Northeastern Illinois Planning Commission (NIPC), and a number of local government agencies. It is the only database in the state to combine these sources and is thought to be the most comprehensive listing of its type.

IEPA annually makes available some of its regulatory information to help HWRIC fulfill the objective of studying hazardous waste issues in Illinois. The IEPA Comprehensive Inventory is a master listing of all generators, transporters, management facilities, and other entities that are regulated by IEPA's Division of Land Pollution Control. Other IEPA files that HWRIC maintains

in the hazardous waste database include Annual Hazardous Waste Reports, a Manifest System, Waste Stream Permit Files, and the Toxic Release Inventory.

CERCLIS is an inventory of uncontrolled hazardous waste sites which are known to the USEPA and have the potential for remedial action under the Superfund Program. HWRIC has received this file from USEPA and uses it in tracking the progress being made to clean up sites in Illinois. Other national-level studies have contributed data to the HWRIC hazardous waste database including a 1986 National Survey of Hazardous Waste Generators and the Transportation, Storage, Disposal and Recovery (TSDR) Facilities Survey (conducted by the Research Triangle Institute). An analysis of these data is reported in HWRIC report RR-059.

One of the ways that the Data Management Program has been able to analyze the components of the overall hazardous waste database is by graphically displaying data files on maps. Some of the files have been geocoded, that is, assigned coordinates based on latitude and longitude or legal description. Using Geographic Information System software (GIS), sites (for example, landfills or waste generators) can be mapped to show relative densities, proximity to population centers, or potential threats to groundwater and soil. The DMP is working toward geocoding more of the hazardous waste database files in order to more accurately portray the waste situation in Illinois.

C. Hardware and Software

HWRIC's primary computing environment is made up of three SUN SPARCstation 2 computers and over 30 microcomputers. These computers are connected to an Ethernet-based local area network (LAN), which is itself connected to the University of Illinois' campus network. The UIUC campus network is inter-connected with the world-wide INTERNET. The connection to the UIUC campus network allows access to Illinois GIS (IGIS) data on the workstations of other ENR divisions. IGIS data of particular interest include the natural resource, land use/land cover, hydrologic, infrastructure, and administrative features of the state.

HWRIC's hazardous waste database resides on a SUN SPARCstation 2. Two additional workstations provide multi-user

HWRIC's Database Files

Filename/Source	Years	Description
Special Waste Disposal Applications/IEPA	1984-1987 1991-92	Submitted by TSD facilities for permit to receive special wastes; includes information on quantities, types and characteristics
Comprehensive Inventory of Special Waste Handlers/IEPA	1984-1987 1990-91	State-regulated generators, transporters and TSD facilities
Manifest History/IEPA	1982-1987 1990-91	Record of chain-of-custody of special wastes from source to disposal; identifies handlers, quantities, and types of waste
Annual Hazardous Waste Reports/ IEPA	1982-1990	Reports of RCRA-hazardous waste sources, amounts, handling and disposal
Water Quality Standards/IEPA	1984, 1987	Criteria for assessing drinking water quality and standards for general use
Water Quality Analysis/IEPA	1984-1986	Water quality data from groundwater and surface water monitoring at RCRA sites
Permit Conditions/IEPA	1984, 1987	Site information and reporting requirements for disposal sites required to monitor local groundwater quality
RCRA/USEPA	1984, 1986	Hazardous waste generator and TSD facility information; includes waste type, handling, and transportation data
CERCLA/USEPA	1984, 1986 and 1988	Information on uncontrolled hazardous waste sites that may qualify for "Superfund" cleanup
Toxic Release Inventory/USEPA	1987-1989	Compilation of chemical releases to air, land and water
Surface Impoundment Assessment/USEPA	1984	1978 inventory of industrial, municipal, agricultural, mining, and oil and gas ponds
National Survey of Hazardous Waste Generators/RTI	1984	Survey data from Illinois' hazardous waste generators; includes types, quantities, and disposal methods of waste produced
National Survey of Hazardous Waste TSDR Facilities/RTI	1986	Survey data from Illinois' hazardous waste TSDR facilities; includes types, quantities and disposal methods
Chicago Metropolitan Sanitary Sewer District/ GCMWRD	1984	List of facilities that discharge waste into Chicago's sanitary sewer system; includes location and activity information
Dun's Market Identifiers/ Dun and Bradstreet	1986	Illinois businesses listed with Dun and Bradstreet; includes address and activity
Inventory of Land-based Disposal Sites/ HWRIC and State Geological Survey	1988, 1992	Historical inventory (1900 - present) of Illinois landfills and other land disposal facilities with emphasis on location, status and type of materials
Spills on Major Illinois Waterways/ HWRIC and State Water Survey	1990	Historical inventory of spills on Mississippi, Illinois and Chicago rivers and Illinois shoreline of Lake Michigan

access to the database as well as additional computing power for database management and GIS software. The three workstations are interconnected via Ethernet, the same connectivity used for the HWRIC microcomputer network. Peripherals include two tape drives, one optical disk drive, a color inkjet printer, a digitizing board and a large Calcomp plotter.

Several software applications are available on the SPARCstations, including: INFO, a relational database management system used for storage, retrieval, and analysis of tabular data; ARC/INFO, a GIS package which manages spatial data representing geographic features; and Oracle, a database management system that offers expanded database analysis capabilities as well as reporting and graphing functions.

HWRIC's administrative PC systems include 30 IBM-compatible PCs and one Apple Macintosh II, all of which are connected to the LAN. Output is provided by five letter-quality laser printers, four dot matrix printers, one plotter and a Polaroid palette for slide making. Major software packages include:

- ♦ WordPerfect (word processing)
- ♦ cc:Mail (electronic mail)
- ♦ Lotus 123 (spreadsheet)
- ♦ Pagemaker (desktop publishing)
- ♦ Freelance, DrawPerfect (graphics)
- ♦ Tgraf (terminal emulation)
- ♦ Rbase System V, dBase III+ (database management system)
- ♦ Inmagic (library database management).

These systems efficiently distribute the day-to-day computing load and provide users with organizational, analytical, and other capabilities that improve job performance. In addition, three telephone modems allow dial-up access to other systems, such as the DIALOG database system and the USEPA's Pollution Prevention Information Exchange System (PPIES), for which Data Management staff provide technical support.

The Center's LAN operates under Novell's Netware local area network operating system. During FY'92 an upgrade to Netware (version 3.11) was installed. A Novell-specific network menu system (NetMenu) was also installed. NetMenu allows easy and efficient use of all network resources (i.e. printers, software, electronic mail, disk drives). The Great Plains Accounting System was installed and customized

with full implementation to begin in FY'93. It provides the Center with a centrally managed and automated accounting system including general ledger, purchase order, accounts payable, and inventory modules.

Through the link to the fiber optic backbone of the UIUC campus network, HWRIC staff can communicate with campus colleagues as well as with others internationally on BITNET and the INTERNET. This communication is facilitated by the cc:Mail package that allows both internal and external communication through one menu-driven interface.

D. Technical Outreach Programming

Several programming projects have involved developing and maintaining outreach software. These are PC-based packages which are available to the public for a small fee that recovers some costs. The packages include the Degree-of-Hazard (DOH), the Waste Reduction Advisory System (WRAS), and the Landfill Inventory System.

In 1990 the DOH system was adopted by the Illinois Pollution Control Board for the deregulation of non-RCRA special waste. The DOH system is a computer program that uses information on the waste characterization of a wastestream, and the toxicities of the components to assess the potential threat that the wastestream poses to the environment. During FY'92, DMP staff re-wrote the original DOH system and converted it using the Clipper compiler. This greatly increased the speed of the program. Improvements were also made to the user interface and the printed reports. A new users' manual was also written. The complete package is now being distributed to industry and IEPA for use in evaluating less hazardous wastestreams.

An update to the WRAS was initiated in FY'92 and is still in progress. Through an agreement with USEPA, the format of the data used by the WRAS will be compatible with that used by the PPIES. Now that the two programs share a common data format, their data will be interchanged and more widely distributed. A separate program for case study input, the Waste Reduction Information Bibliography Input (WRIBIN) program, has been created and is ready for distribution. The WRIBIN format has been designed to be compatible with HWRIC's

WRAS, USEPA's PPIES, and the proposed United Nation's format. Thus, the WRIBIN can be used to input information into each of these separately maintained systems.

A PC-based Landfill Inventory System was created to allow easy access to detailed landfill information. The program is menu-driven and built around data-specific picklists. The database was assembled from several sources including USEPA, IEPA, NIPC, and studies sponsored by the Center with the Illinois State Geological Survey (ISGS).

E. Technical In-House Programming

There are several in-house programming projects which involve developing and maintaining custom software for internal use. These are usually PC-based packages which operate on the LAN in multiuser mode.

The Mailing Outreach Database (MOD) is an important in-house program that manages an extensive mailing list of government and industry contacts. Both the program and manual were expanded and improved in FY'92.

Two custom programming projects have been identified which will interface with the Great Plains Accounting System. Work began on these projects and will continue into FY'93. These include an "electronic blue sheet" program which will allow all employees to initiate a paperless purchase request. An "obligation tracking system" will permit the HWRIC fiscal staff to more efficiently maintain control of the operating budget.

The "annual leave program" used by the personnel staff was updated and compiled for faster operation during FY'92. The need for a program to track technical inquiries from outside clients and provide follow-up reminders is currently being analyzed and defined.

As mentioned in Section C, upgrades to the Novell network operating system were made in FY'92. A LAN menu system was installed (NetMenu) and customized for the Center. Along with these improvements, Data Management staff streamlined the login process. It is now more flexible, allowing anyone to use any available PC workstation. A "smart" message-of-the-day was implemented.

During FY'92, the Prime 9650 computer, which had served as the mainframe for the hazardous waste database, was replaced with two SUN SPARCstation 2 computers. Disk storage was increased to a total of 2.4 Gigabytes.

The IGIS network office replaced its central Prime computer by decentralizing the work and placing a SUN SPARCstation 2 "divisional" server at HWRIC and each of the other scientific survey locations. HWRIC's plotter, digitizer and two graphic workstations were connected to the HWRIC server and the databases were migrated to the new system.

ORACLE relational software was purchased for the SUN computers to allow for more extensive analysis of the databases and to continue sharing of data with the ARC geographical software (previously licensed to HWRIC along with the other scientific surveys). The yearly hardware maintenance costs were reduced by \$22,260, the disk storage space was doubled, the computational processing was increased by 122,000% (as compared to the Prime), and there are now three independent networked workstations that can access the data instead of one Prime computer.

F. Database Projects and Applications

Critical Trends Assessment Project (CTAP)

During FY'92, DMP staff have been involved with the planning and preliminary analysis for the CTAP. Governor Edgar has directed ENR and the Governor's Science Advisory Committee (GSAC) to conduct an environmental trends analysis and to report to the public on the condition of Illinois' environment. HWRIC has been participating in the planning of the technical analysis for this project and has been working toward identifying the most important trends to analyze.

Work on this project will continue into FY'93 and Data Management staff will be developing maps, demonstrating relationships and helping to interpret environmental data with specific analysis of waste generation from manufacturing operations, in addition to method and location of disposal. The final project should be completed by September 1993 and the findings will be presented in a report and discussed at public meetings to be held around the state.

In addition to the CTAP project, DMP staff completed a number of tasks on a solid waste management project. The purpose of this project was to update and develop databases to provide public and county solid waste planning committees with data for locating new landfill sites. The most significant of these tasks was the update of the Inventory of Landbased Disposal Sites.

Updating the Inventory involved evaluating the current database and developing a new database structure to make it easier to use and update as well as eliminating the potential for duplicate records. More current information from IEPA was obtained and used to check data and add new records to the database. As a result of the updating based on the 1990 IEPA Comprehensive Inventory File, corrections were made to 378 records. The updating included data on the 875 illegal dumps discovered since 1988, plus 135 new sites. This updating process has provided the opportunity to add new kinds of information to the hazardous waste database. For example, 119 composting sites and 556 recycling facilities were added.

Another major updating task for the Inventory of Landbased Disposal Sites involved a mail campaign to county solid waste planning commissions or health departments to verify the records found in the database and also to request any other useful information that should be included. Responses and available information varied from county to county but generally the interest in solid waste issues seemed fairly high.

As of August 1992, agencies representing 64 of 102 counties in the state have responded to the request for validation of existing county landfill information and have provided new data for approximately 140 records. Although not all counties were able to contribute information, many were impressed with the depth of HWRIC's information and felt that the inventory would be of use in their efforts to site new landfills.

During the early part of FY'93, the new information will be integrated into the Inventory database and a new update will be completed. The database will continue to be available for purchase. Data Management staff will also respond to requests for searches of the database. A search fee is charged based on the number of records found in the search area.

The HWRIC comprehensive hazardous waste database has been frequently used to answer questions posed by the public regarding environmental conditions in particular areas of the state, and by other state agencies and individuals seeking specific information about certain wastestreams and chemicals. Data Management activities during FY'92 included responding to information requests, but perhaps not as frequently as in previous years. Because of DMP staff turnover and limited resources, requests were prioritized, and responses were made only to the most critical requests.

A number of special requests were completed during FY'92. Because of the state's interest in the planning process for the third Chicago regional airport, GIS was used to create maps of the proposed airport site, to pinpoint the location of waste generators, land disposal sites, and other areas of potential concern. Also, a professor from UIUC requested information about landfills in the state to plan a curriculum for an academic course related to environmental issues. A request was also received from a researcher at the Field Museum in Chicago who was developing an exhibit about the life cycle of landfills in the Chicago area. During FY'93, Data Management staff will continue to use the hazardous waste database to provide information that can be used to further educate the public about hazardous waste issues.

G. Objectives for FY'93

These five major tasks or projects are the planned FY'93 focus for the DMP staff.

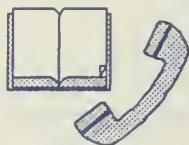
- ◆ Support the Industrial D Waste Project that HWRIC has undertaken for USEPA. The project will examine Illinois and Pennsylvania laws and regulations relating to non-hazardous industrial (Industrial D) wastes. Characterization of the waste data will include the analysis of:
 - manufacturing processes,
 - composition,
 - volume,
 - management methods,
 - leaching test data,
 - wastestream Degree-of-Hazard, and
 - disposal processes

A risk evaluation process will compare different methodologies used by the two states and analyze the largest and most common wastestreams. A preliminary database will be defined using data from both states to provide USEPA with a prototype for a national database of Industrial D wastes.

- ◆ Expand and enhance HWRIC's hazardous waste database in FY'93 by continued acquisition and documentation of new data files, modification of existing files to allow for maximum benefit from new software and computer hardware, and further integration for access from within the Center's LAN and from the IGIS network. Files to be added are: the 1990 Toxic Release Inventory (TRI); updates of several IEPA data files; and new files created as part of the Critical Trends Assessment Project. These files will be integrated with existing files and the new information will be used to upgrade site location data.
- ◆ Continue to provide WRAS program updates, as well as continued user support. The agreement with USEPA for co-development of the stand-alone WRAS and their PPIES will require conversion of existing data to the newly agreed upon format. Coordination of this effort and the probable inclusion of the United Nations' database into this format will mark an important task for DMP staff. Software programs for case study input and an updated WRAS inquiry and retrieval program will be distributed.
- ◆ Automate the process for conducting searches of the HWRIC databases. Data Management staff hope to be able to answer all types of requests from the public and industry in a more timely fashion. Because of capabilities that are available with new software, it is hoped that a 10-day' response time will be achieved during the next year, particularly for "Responsible Property Transfer" requests.

◆ Support HWRIC administration functions, including:

- Complete integration of Great Plains accounting system for state and UIUC accounts
- Design and implement of a human resource system
- Establish an electronic link through UIUC to the state of Illinois computers for increased efficiency and timeliness of accounting, purchasing and personnel functions, and
- General staff support for PC and network applications and problems.



Chapter 5. Information Services Program

A. Introduction

Fulfilling HWRIC's legislative mandate to compile, analyze, and disseminate hazardous waste-related information is the principal responsibility of the Information Services Program (ISP). Program staff fill requests for information from industry representatives, educators and citizens. The ISP provides support to HWRIC staff who use HWRIC's information resources to resolve waste management problems and to promote pollution prevention in Illinois.

Providing hazardous waste-related information to the state is one of HWRIC's primary objectives. This task was mandated in the legislation that created the Center, the Hazardous Waste Technology Exchange Service Act (Public Act 83-1436, 1984). Recent legislation goes even further in mandating information services. The Toxic Pollution Prevention Act (Public Act 86-915, 1989), established a Toxic Pollution Prevention Assistance Program at HWRIC, mandating a variety of programs, including a clearinghouse. Funds have never been appropriated for the Toxic Pollution Prevention Act (TPPA).

The program's main resources are the Library and Clearinghouse collections of information materials. In addition to managing these resources, ISP staff share responsibility for conducting public affairs and outreach activities, including production of many of the Center's publications.

B. Library

Collection Development

The Program Manager has primary responsibility for the library collection. The Library contains books, government reports, journals, audio/visual materials and articles that support the work of all Center staff.

Library materials are not loaned directly to individuals outside HWRIC but formal interlibrary loan requests are honored. During

FY'92, program staff completed a project of acquiring a wide range of pollution prevention articles, books, and reports for the Library. This special acquisitions effort was part of a USEPA cooperative agreement (see discussion in HWRIC FY'91 Annual Report).

Beginning in 1990, the HWRIC Library received a portion of Build Illinois funds especially targeted for expansion of the analytical chemistry and pollution prevention materials. This acquisitions project was completed in FY'92.

With the close out of Build Illinois funds, and a 20% budget cut for FY'93, the Library must cut back on acquisitions. The Library Committee began reviewing journal subscriptions for potential cancellations near the end of FY'92. Less will be spent on books in the future, since most core items have been purchased. Journals, where information about new industrial and scientific developments first appears, will continue to be a major expenditure.

The total Library collection grew from 6,587 items to 8,046 in FY'92. Most of the items added to the collection were books and government reports (see Table 5-1).

Collection Maintenance

Library collections need continual maintenance to best serve library users. Unfortunately, temporary vacancies in the program forced maintenance of the journals collection to be a lower priority in FY'92. Maintenance of the books and government reports collection remained current. In addition to book maintenance, Library staff enhanced subject access to a number of book records via a database maintenance project.

Collection Usage

The average number of items charged out to all HWRIC staff each month for FY'92 was 394, an increase of almost 100 compared to the previous year. Borrowing of books for HWRIC staff via campus and Lincoln Trail Libraries System (LTLs) services is up 50% from the previous fiscal year (see Table 5-2).

Table 5-1

FY'92 HWRIC Library Statistics for Collection Development

Number of Items In Collection at End FY'92

Books & government reports	3218
*Audio/Visual materials	60
Microfiche cards	~ 2000
Periodical titles	248
Pollution prevention articles	520
Maps	~ 2000
Total	8046

Items Added FY'92

Books and government reports	450
*Audio/Visual materials	8
Microfiche cards	~ 1000
Periodical titles (8 new; 4 gifts; 12 revised)	24
Pollution prevention articles	20
Maps	0
Total	1502

Database Records Revised 34

Books, reports withdrawn 5

Periodical subscriptions canceled or gifts no longer received 4

*Video and audio tapes and slide sets

Staff requests for journal reprints held at UIUC libraries are up 11% from FY'91. HWRIC's affiliation with UIUC enables library staff to obtain reprints much more efficiently and inexpensively than would otherwise be possible.

The Library Acquisitions List is mailed to 53 environmental and library professionals nationwide, 28 in Illinois (11 on the UIUC campus), and 25 outside the state. This form of outreach generates interlibrary loan requests. Nevertheless, lending of HWRIC materials to outside requestors via interlibrary loan is down 20% from the previous year. This year library staff has faxed more journal articles to other libraries in response to interlibrary loan requests.

Table 5-2

FY'92 HWRIC Library Statistics for Library Services

Services Provided

Periodicals routed to staff 179

Average number of items charged out to staff each month 394

• Interlibrary Loans (I.L.L.)

Items lent 40

Items borrowed 70

Article copies requested via I.L.L. 79

Articles copied at UIUC libraries 254

• Reference Services

HWRIC queries 186

Outside queries 110

Subject bibliographies produced 26

Faxes sent 19

Faxes received 9

• Online Searches

DIALOG databases 4

CARL UnCover (UIUC journal citations) 16

IBIS (UIUC journal citations) 39

IL Legislative Information System* 33

US EPA Pollution Prevention Information Exchange System 4

National Library of Medicine databases 4

American Chemical Society STN 3

*Does not include count for PIO searches

HWRIC Access to the Library

The ISP maintains current bibliographic databases of the Library books/reports and journals collections, and of the Clearinghouse collection, using the INMAGIC program. The databases are available in a search mode on HWRIC's local area network (LAN) -- all staff have database access from their office personal computers (PCs).

During the last quarter of FY'92, Library staff began reviewing and standardizing the word format for subject descriptors and author names used as access points in the books/reports database. The project evolved to include additional aspects (such as standard book numbers and corporate authors) of book and report records. The project was about 80% complete by the end of FY'92. At completion, both lists will be printed out for use as cataloging tools.

Outside Access to the Library

In addition to interlibrary loans, access to the HWRIC Library collection will be offered via several special projects. The projects are described below.

In FY'92 HWRIC began a cooperative effort with the University of Wisconsin Solid and Hazardous Waste Education Center in the creation of the a Great Lakes Technical Resource Library for Pollution Prevention. The long term goal of this project is to provide access to many states' pollution prevention information collections. At this point, the Technical Resource Library is principally a cooperative database of pollution prevention information materials held at various states' program offices within USEPA Region V (Minnesota, Wisconsin, Illinois, Indiana, Michigan and Ohio). The database is implemented using INMAGIC. HWRIC's effort on this project has included participating in planning sessions at regional pollution prevention roundtable meetings, and providing an electronic copy of all HWRIC Library INMAGIC records to form the core of the regional database. The subject and author standardization task (described above) helped guarantee that quality data were contributed to this effort. By the end of FY'92 HWRIC received the first version of the regional database from Wisconsin. The database has already been used as an interlibrary loan tool, and will eventually be made available to all HWRIC staff.

The HWRIC Library is also part of a collaborative grant proposal submitted by the Lincoln Trail Libraries System to the Illinois State Library. This proposal asks for support to add holdings of some school and special libraries to the LTLS library database. If funded, this process would publicize HWRIC's specialized information resources to a broader audience of potential users. At this time, the status of the proposal is unknown, due to pending budget cuts at the State Library.

Library Services

Reference

Seventy seven (77) more reference queries were answered in FY'92 than in FY'91 (see Table 5-2). This is partly due to an increase in the number of HWRIC employees this year. Library staff produced the same number of topical bibliographies of library holdings this year as last. Bibliographies were created for both HWRIC staff and outside users.

Online Searches

Online computerized services often provide answers to reference queries. Library staff performed 35 more online searches in FY'92 than in FY'91 (see Table 5-2). This increase was due to several factors. During FY'92, HWRIC gained access to the UIUC campus network, and thus to the global Internet network. Library staff can now access online databases using a modem or directly via the Internet. This year the UIUC library system added two journal citation resources on the Illinet Online Plus system, available on the Internet. *CARL Uncover* indexes articles in close to 10,000 journals in its database. The *Illinois Bibliographic Information System* (IBIS) includes several Wilson indexes (*Science and Technology Index*, the *Reader's Guide*, etc.) and the *Current Contents* topical series of journal tables of contents and citations, covering thousands of journals. Library staff were able to search CARL or IBIS more easily and inexpensively than commercial database resources. Searching of commercial online databases, including the American Chemical Society's STN database group and the *Illinois Legislative Information System* (LIS), also increased this year.

C. Clearinghouse

The Clearinghouse includes two collections of information materials, most of which are distributed at no charge. The first is the collection of HWRIC-produced reports. Most of these are final reports on research projects sponsored by the Center. Also included are technical and administrative reports. HWRIC charges a nominal fee for several often-requested, lengthy reports to recover some reproduction costs. A list of HWRIC reports produced in FY'92 appears as Table 5-3.

FY'92 HWRIC Publications

Research Reports

HWRIC RR-058	Optimal Time for Collecting Volatile Organic Chemical Samples from Slowly Recovering Wells. Sheng-Fu J. Chou, Beverly L. Herzog, John R. Valkenburg & Robert A. Griffin
HWRIC RR-057	Toxic Volatile Organic Chemicals in Urban Air in Illinois. Clyde W. Sweet & Stephen J. Vermette
HWRIC TR-006	Applications of Supercritical Fluid Processing to Environmental Control. Charles A. Eckert, Gregory W. Leman & David L. Tomasko
HWRIC TR-005	Removal and Recovery of Carbon Disulfide Emitted by the Viscose Process. Michael J. McIntosh
HWRIC TR-004	The Feasibility of Reclaiming Shell Material from Investment Castings. Timothy M. Peters & Daniel L. Twarog
HWRIC TR-003	X-TRAX™ Laboratory Treatability Study of Jet Fuel Contaminated Soil from Chanute Air Force Base Near Rantoul, Illinois. Peter G. Romizick & Carl Swannstrom

Technical Publications

HWRIC TN92-023	Where to Find Illinois Waste Management Data Files. Environmental Data Factsheet Series.
HWRIC TN92-022	Degree of Hazard Evaluation Program and User's Guide. Martin B. Bailey, Gary D. Miller & Laurie J. Case
HWRIC TN92-021	In Living Color: Painting Challenges of the '90s. A National Waste Reduction Teleconference for Industrial Painting Operations.
HWRIC TN92-020	Waste Reduction in Metal Coating. Pollution Prevention Information and Updates Series.
HWRIC TN92-019	Pollution Prevention Services of the Illinois Hazardous Waste Research and Information Center. Pollution Prevention Information and Updates Series.

Administrative Publications

HWRIC AD92-021	Format Guidelines for Principal Investigators, Authors and Editors. Kathleen J. Nojd & Sara Tompson
HWRIC AD92-020	Mailing Outreach Database. Document on the Use of the Software for Access to the Database.
HWRIC AD91-019	Annual Report FY'91.
HWRIC PA92-015	Hazardous Waste Research & Information Center Brochure.

The second Clearinghouse collection includes brochures, pamphlets, and other brief publications produced by HWRIC, IEPA, USEPA, and other agencies. Permission is obtained from the publishers to redistribute these items via the Clearinghouse. Currently these publications are distributed at no charge.

Separate bibliographies are maintained for the Clearinghouse, one for HWRIC-produced reports and one for other items. In FY'92, for the first time, topical bibliographies were created that included reports from both collections. Topics included pollution prevention, education, and household hazardous waste.

Collection Development

The Information Assistant is primarily responsible for the Clearinghouse collection. Collection development activities in FY'92 focused on expanding the number of items addressing industrial pollution prevention. Items were added to the "Industry-Specific Waste Reduction" and "Pollution Prevention" categories. This effort was intended to better meet the Toxic Pollution Prevention Clearinghouse mandate, and to respond to the increasing number of requests for pollution prevention materials.

During FY'92, 32 publications were added to the non-HWRIC section of the Clearinghouse, and 16 were removed because the information was dated or inaccurate. Twelve items were added to the HWRIC report section of the Clearinghouse, including a series of technical factsheets produced by HWRIC's Education and Training Specialist (see Table 5-3).

Usage Statistics

Two categories of Clearinghouse usage statistics are gathered:

- ◆ numbers and categories of items distributed, and
- ◆ numbers and types of requests for information.

Items distributed are monitored using Clearinghouse tally sheets. Numbers and types of requests for items are tallied from the Clearinghouse information request forms. This statistic does not directly correlate to the items distributed statistic, since items are sometimes distributed without the use of request forms. Because the Clearinghouse is an open collection, usage statistics are not as accurate as they would be for a closed collection with a staff person dedicated solely to responding to requests.

In FY'92, 6,803 HWRIC-produced reports were distributed from the Clearinghouse. This number is down about 3% from FY'91. Nearly 1,400 research reports were distributed, the majority of them peer-reviewed reports (RR series). Over 5,000 technical reports were distributed. The most frequently requested and distributed items were the chemical hazards posters, the pollution prevention factsheets, and the *Illinois Small Quantity Generator's Manual* (see Table 5-4).

In FY'92, the non-HWRIC items distributed from the Clearinghouse totaled 3,099. This amount is also down about 3% from FY'91. In Table 5-5, these statistics are organized by the 22 topical categories of the collection. Almost 25% of the items distributed were from the industry waste reduction and pollution prevention categories. Nearly another 25% were distributed from the household hazardous waste category.

In FY'92, a total of 1,117 requests for Clearinghouse information were received (see Table 5-6). This figure is down about 23% from FY'91. This measure indicates that this is an opportune time to promote the Clearinghouse to Illinois industries and citizens. It has been two years since extensive publicity was done on HWRIC's information resources. Technical assistance staff use the Clearinghouse as a resource for items to distribute to industry personnel and to refer industry representatives directly to HWRIC's resources (generating information requests). There was a turnover in HWRIC's technical assistance staff in FY'92, with a gap of several months before the position could be filled. This could have had a negative impact on Clearinghouse usage.

Over 50% of the requests came from letters and report announcements. Most of the remaining requests came from telephone calls. About 50% of the requests for Clearinghouse items came from industry representatives. Other large requestor categories were state government officials and educators.

In FY'92, 524 requests came from Illinois companies or individuals, and 593 from outside the state. The outside requests were partially due to Center staff's participation in various national waste management organizations, particularly the National Roundtable of State Pollution Prevention Programs. These organizations are also a good source of information materials from other states, some of which have been acquired for the Library and Clearinghouse.

D. Production of Publications

HWRIC maintains several report series: Research and Technical Research reports, under the purview of the Research Program; and Technical, Administrative, and Public Affairs reports, handled by the ISP.

Table 5-4

Distribution of HWRIC-Produced Clearinghouse Publications							
Report No.	Sent	Report No.	Sent	Report No.	Sent	Report No.	Sent
RR-001	43	RR-031	21	RR-048	15	TR-005	27
RR-003	4	RR-032	1	RR-049	102	TR-006	3
RR-005:1 RR-005:2	6 5	RR-033	0	RR-050	33	ISSJR-2	8
RR-010	7	RR-034	0	RR-051	38	TN88-006	2
RR-011	19	RR-035	12	RR-052	9	TN88-008a TN88-008b	1474 1464
RR-013	12	RR-036	14	RR-053	19	TN88-012	59
RR-018	16	RR-037	6	RR-054	35	TN89-013	896
RR-019	28	RR-038	9	RR-055	64	TN89-014	21
RR-020	5	RR-039	17	RR-056	333	TN89-015	13
RR-021	9	RR-040	5	RR-057	114	TN90-017	347
RR-022	4	RR-041	27	RR-058	21	TN91-018	192
RR-023	18	RR-042	25	RR-059	0	TN92-019	525
RR-024	4	RR-043	5			TN92-020	202
RR-026	16	RR-044	47	TR-001	7	TN92-021	1
RR-027	21	RR-045	5	TR-002	8	TN92-022	0
RR-029	9	RR-046	2	TR-003	80	TN92-023	2
RR-030	14	RR-047	23	TR-004	7	TN93-025	30
*NOTE: Administrative and Public Affairs publications are not tallied.							
FY'92 Total Distribution for HWRIC-Produced Publications				6611			

For each Research and Technical report, a report announcement is created and mailed using one or more specialized mailing lists. The announcements include return portions for ordering reports. Report announcements are also mailed to a list of researchers and administrators in the hazardous waste field. In FY'92 the ISP worked with the Research Program to update and streamline the report announcement mailing list on the Mailing Outreach Database (MOD).

Research Program staff distribute new reports to investigators and others as appropriate. As mandated by state law, multiple copies of all HWRIC publications are sent to the

Illinois State Library to be distributed to state document depository libraries. Many HWRIC reports are also forwarded to the National Technical Information Service (NTIS) repository, which serves as both an archive and an ordering clearinghouse for government agencies' reports. Reports sent to NTIS are those the Research Program staff judge to be most in demand.

In FY'92 charges were instituted for several popular reports that have been reprinted, in order to recover some of the production costs. It is anticipated that in FY'93 it will be necessary to charge for all HWRIC reports, due to a drastic reduction the Center's printing budget.

Table 5-5

Distribution by Category of Non-HWRIC Clearinghouse Publications

Category	Amount Distributed
Agriculture	23
Asbestos	175
Chemicals	356
Environmental Laws	311
General	180
Groundwater	82
Household Hazardous Waste	594
Industry Waste Reduction	406
Laboratories	56
Materials Exchange	19
OSHA	20
PCBs	13
Pesticides	77
Pollution Prevention	265
Radioactive Waste	47
Recycling	73
Schools	105
Small Quantity Generators	74
Title III	22
Toxicology	77
Treatment, Storage & Disposal	3
Underground Storage Tanks	121
FY'92 Distribution Total	3099

In FY'92, nine non-research publications were produced (see Table 5-3). Administrative and public affairs publications produced include revisions of HWRIC's general brochure, report format guidelines handbook, and a users' guide for the MOD.

ISP staff handle collection and compilation of material for a variety of mandated reports. In FY'92, these included the

Table 5-6

Clearinghouse Requests by Categories

Requestor Categories	
Conference/Workshop/Seminar*	1
Educator	148
Local Government	41
State Government	215
Federal Government	78
Individual Citizen	105
Industry	508
Media	6
Public Interest Group	19
Trade Association (also see Industry)	1
Other	0
Geographic Distribution	
Illinois	524
Out-of-State	593
Request Methods	
Letter (Includes report announcement return slips)	704
Staff Referrals (when known)	19
Telephone Requests	387
Visitors*	7
FY'92 Clearinghouse Information Requests Total	1117

*These categories have not been accurately tracked due to lack of staff and the open nature of the collection.

annual report, three reports to the Board of Natural Resources and Conservation, and the monthly activities reports to ENR.

E. Mailing Outreach Database (MOD)

The MOD is a contact list database implemented in the dBase program, written specifically for HWRIC's needs. The MOD

allows searching and sorting by personal and organizational names, functions (e.g. report announcement), or groups (e.g. State Geological Survey). The MOD also incorporates Research Program functions such as tracking peer reviewer functions. The MOD provides several output formats, including lists, mail merge files, and mailing labels. The Information Assistant is responsible for MOD maintenance. The MOD is available to all HWRIC staff as a local area network menu option.

Like the Library and Clearinghouse databases, the MOD is an access tool to information resources that must be constantly maintained in order to be useful. Several MOD maintenance projects were undertaken during FY'92. During the first half of the fiscal year, Data Management staff with some support from ISP staff revamped the MOD to enhance list creation and output capabilities. In the latter half of the year, ISP and Research staff created and mailed an update letter to every person (close to 4,000) listed in the MOD. By the end of FY'92, HWRIC had received responses from about half of the recipients.

F. Other Services and Projects

Legislative Issues

ISP staff assist the Director with review of bills pending in the Illinois General Assembly. In FY'92, Center staff reviewed and commented on a number of bills dealing with toxic substances or hazardous waste. Wording of a number of bills was refined to clarify HWRIC's role in providing the state non-regulatory technical assistance and research support.

Meetings

Another ISP responsibility is coordination and publication support for meetings, workshops and conferences. In FY'92 ISP staff and resources were utilized by Laboratory Services staff in organizing and publicizing the first national ICP-MS (inductively coupled plasma mass spectrometry) Technical User's Meeting, held at HWRIC in May 1992.

ISP staff provided assistance for the Fifth Annual Governor's Pollution Prevention Awards ceremony, held in November 1991 in Chicago. In addition to procuring the award plaques, ISP staff created a Governor's Pollution Prevention

Awards history booklet that covered award and certificate winners for all five competitions.

Program staff coordinated a Great Lakes Protection Fund meeting held at the HML in May. HWRIC's MOD was used to create the invitation mailing list. ISP staff designed a flier for the meeting and distributed it to UIUC staff.

ISP staff also provided support for the following meetings held at the HML: HWRIC Program Advisory Panel Board; Nature of Illinois Foundation (NIF) joint meeting with representatives from the Governor's Office, ENR and the Department of Mines and Minerals; Chicago Bar Association Environmental Division; and Illinois Department of Transportation pollution prevention training workshop.

ISP staff designed a poster display for the Illinois Science Teachers annual conference. The display featured HWRIC's information and technical assistance resources.

Journal Articles

NIF works statewide to foster an understanding of and appreciation for Illinois' natural resources, and promotes the work of the Illinois scientific surveys and HWRIC. ISP staff coordinate much of HWRIC's interaction with and support of NIF.

The Winter 1992 issue of NIF's *Nature of Illinois* magazine featured "*Hazardous Waste: Past Present, Future -- Illinois Scientists Try to Find and Cure the State's Hazardous Waste Problems*" by William H. Allen, science writer for the "St. Louis Post-Dispatch." The article highlights the Hazardous Materials Laboratory as the setting for HWRIC's statewide efforts. ISP staff coordinated Allen's work with HWRIC.

Program staff participated in meetings of the NIF Board, and worked with NIF staff to create several articles for the "Surveying Illinois" section of *Nature of Illinois* (see Table 5-7).

The March/April 1992 issue of ENR's *Illinois Resources* newsletter included "*Hazardous Waste Research and Information Center offers valuable information on chemical hazards in the home.*" ISP staff helped create this feature article, which includes a reproduction of HWRIC's chemical hazards posters.

Table 5-7

HWRIC Articles Appearing in the *Nature of Illinois* Magazine

Title	Topic
<i>Leftover Paint--What a Waste!</i>	HWRIC's legislatively-mandated investigation of paint disposal options
<i>Getting the Lead Out</i>	HWRIC factsheet on disposal of lead-acid batteries
<i>TNT Poses Wastewater Risks</i>	HWRIC's laboratory staff cooperative investigation with the US Army on TNT "redwater"
<i>Pollution Prevention Benefits Bottom Line</i>	HWRIC's presentation of the annual Governor's Pollution Prevention Awards
<i>HWRIC Project Reduces Waste in Metal Coating Process</i>	Study on a new ultrafiltration process developed by HWRIC for manufacturers of metal products
<i>The UN Comes to Champaign</i>	United Nations and USEPA computer programs representatives visit HWRIC to discuss pollution prevention data resources

The ISP cooperated with the Pollution Prevention Program to feature an article on Advanced Filtration Systems, Inc. (AFSI) in the May/June 1992 issue of the Illinois Manufacturers Association magazine *The Illinois Manufacturer*. AFSI was one of the Governor's Pollution Prevention Award winners.

Visitors

HWRIC's move to the HML has led to an increased number of visitors from a variety of locations. According to the HWRIC visitors logbook, over 1,600 individuals visited during FY'92 (not including service and installation visits). ISP staff frequently provide information and/or tours for visitors. Several international delegations visited HWRIC, including representatives from the United Nations Environmental Program, and chemists from England.

G. Goals

Evaluation of Progress

Information Services Program goals are driven by the program's service and publication orientations. Five of 12 program goals were accomplished in FY'92. They were:

- ♦ refining the journal routing process
- ♦ regularizing copyright clearance procedures
- ♦ implementation of changes indicated from journal routing analysis project

- ♦ revising the MOD request form to mirror the MOD screen, and
- ♦ expanding outreach efforts via publication of journal articles.

The ISP was unable to compile and print the bibliography of library pollution prevention holdings in bound report format. It currently exists in a loose list format, and is distributed by the ISP and Pollution Prevention staff. This bibliography will be evaluated to determine whether demand is sufficient to warrant publishing it in FY'93.

The library materials checkout function has not been automated. The current manual system allows for self-service checkout. ISP staff is unavailable to provide this library service for the full 40 hours a week the Library is open, so the goal of automated checkout has become a lower priority.

Due to budget cuts, no further investigation was made of bibliographic products on CD-ROM. Other goals were not accomplished due to lack of time or because they became low priorities.

Progress was made on the FY'91 goal of increasing information dissemination outside HWRIC. ISP staff participated in several professional meetings and workshops, and spoke formally or informally about HWRIC's programs. The ISP facilitated more journal coverage of the Center this year.

In FY'92 a goal of expanding HWRIC's educational efforts was proposed, including setting up displays at area community colleges and high schools. ISP staff did not accomplish this due to lack of time. However, the Center was able to hire an Education and Training Specialist (for the Pollution Prevention Program) to begin focusing on this goal, and HWRIC materials were displayed at some local student science fairs.

Efforts to cooperatively share information with library and environmental professionals at the state and national levels continued. ISP staff assisted many programs that were setting up pollution prevention information collections. The Program Manager gave several environmental information talks, both locally and at a national librarian's meeting. The Manager continues to regularly meet with ENR librarians, and with UIUC campus science librarians, and to serve on the board of the Lincoln Trail Libraries System.

Future Plans

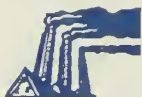
For Fiscal Year 1993, the ISP has set several goals. One program goal is automating Clearinghouse inventory functions. The Clearinghouse publications are currently listed on the INMAGIC database. This project will incorporate the manual tracking and ordering system into the database, which will allow for quicker ordering of publications, as well as creation of inventory reports.

Another program goal is to develop a more proactive approach to information creation and dissemination. Specifically, focus will be on utilizing ISP monthly statistics and personal observations to identify areas where HWRIC as a whole can provide more or better information, and then working with other staff to create these information materials.

ISP staff will continue to network with other information and environmental professionals on projects like the Great Lakes Technical Resource Library. The ISP will be part of HWRIC's cooperation with the Department of Commerce and Community Affairs (DCCA) to develop a small business pollution prevention assistance program and clearinghouse. DCCA's efforts are being implemented under the aegis of the federal Clean Air Act.

Other goals for the coming year include:

- ♦ further renovation of the MOD groups and functions
- ♦ better organization of HWRIC's audio/visual materials and access to them, and
- ♦ emphasizing communication within the program and with other HWRIC staff members, to better serve HWRIC's needs and the needs of the citizens and businesses of Illinois.



Chapter 6. Pollution Prevention Program

A. Introduction

In 1986 HWRIC's Pollution Prevention Program was established as a long-term approach to solving Illinois' future waste management problems. Direct technical assistance to industry, education programs, and research were used to promote waste reduction and improve waste management. In 1989 the Illinois Toxic Pollution Prevention Act (TPPA) was passed which formalized HWRIC's Pollution Prevention (P²) Program and delineated specific responsibilities. These responsibilities are summarized in Table 6-1.

An effective pollution prevention program must include waste reduction in all media -- air, water, and land. A strong multimedia program must be supported by aggressive research, information, recognition, and technical assistance. Useful components of a quality pollution prevention program include:

- ♦ Conducting facility pollution prevention assessments to develop plans for the effective management of industrial processes and reduction of wastestreams
- ♦ Assisting industry in evaluating the technical and practical feasibility of utilizing the services of companies and organizations for reducing and recycling wastestreams
- ♦ Eliminating, reducing, or substituting for the use of toxic materials, and
- ♦ Testing the capabilities of equipment and techniques for reducing, detoxifying, or recycling wastestreams.

A full description of HWRIC's Pollution Prevention Program was recently published (Thomas and Miller, 1992, see Appendix A). The program activities, described in this chapter, are:

- ♦ provision of industrial technical assistance
- ♦ development and demonstration of clean technologies

- ♦ recognition of exemplary pollution prevention accomplishment through the annual Governor's Pollution Prevention Awards, and
- ♦ education, training and technology transfer.

No state appropriations have been provided under the TPPA to carry out HWRIC's responsibilities. Approximately \$500,000 of HWRIC's annual state budget is used for pollution prevention activities. Approximately \$180,000 of federal funds were obtained in FY'92 to supplement this support.

Table 6-1

Toxic Pollution Prevention Act (P.A. 86-914 as amended by S.B. 2253) Charges HWRIC with These Responsibilities

- Provide Information and publicize the advantages of pollution prevention
- Establish courses, seminars, etc. and produce publications
- Develop and provide curricula and training
- Research pollution prevention methods
- Provide on-site technical assistance to identify opportunities and develop plans
- Sponsor pilot projects to develop and demonstrate innovative technologies
- Establish and operate a clearinghouse
- Use engineering field internships to identify opportunities

B. Technical Assistance

Introduction

The most visible aspect of HWRIC's Pollution Prevention Program is technical assistance. P² staff provide information and services to Illinois citizens, businesses, educational institutions, communities, and governmental units relating to environmental problems. P² program personnel emphasize source reduction, recycling, and other methods of waste reduction. Other services include: guidance on regulatory and permitting matters; recommendations on appropriate waste handling methods; and referrals to qualified service

organizations. During FY'92, assistance was provided in 431 instances.

Because HWRIC is a non-regulatory organization, the assistance provided is advisory only; companies and individuals are not required to follow the recommendations and advice given by Center staff. HWRIC does not report site-specific findings to state regulatory agencies.

Types of Assistance Provided

Program staff provide information by answering questions over the telephone, providing literature and other materials, and conducting presentations and seminars. P² personnel also conduct site visits and pollution prevention assessments for Illinois industries. All inquiries are documented. The four major groups assisted in FY'92 were: industry, general public, governmental units, and educational institutions.

Industry

Program staff responded to 217 industry inquiries in FY'92, one third of which were for pollution prevention. This assistance included distribution of information and presentations on establishing pollution prevention programs. Several on-site visits and assessments were conducted as well. Center staff also provided compliance assistance by explaining new and existing regulations. Generally, inquiries regarding regulations and compliance are also referred to appropriate Illinois Environmental Protection Agency (IEPA) staff, especially when the industry should be coordinating their efforts with the regulatory agency.

Topics of interest to industry in FY'92 included:

- ♦ pollution prevention
- ♦ trade and technology information
- ♦ database information (toxic release reporting, remedial action sites, etc.)
- ♦ waste handling methods
- ♦ property assessment requirements, and
- ♦ training information.

General Public

Program staff responded to 125 inquiries from Illinois citizens and community groups. The majority of these individuals and organizations were interested in information on

the proper handling and disposal of household hazardous waste. Program staff provided schedules to callers for the household hazardous waste collection events sponsored by IEPA, and suggested safe handling methods for common household products such as paint. The assistance provided was limited due to the small number of collection events held in the state in FY'92. From the calls it is clear that Illinois citizens and communities would like to have household hazardous waste collection facilities available in all areas of the state throughout the year. Other issues of interest to communities were: testing and removal of lead paint and asbestos; public health issues; waste disposal issues; and general information on Illinois environmental problems.

Governmental Units

Technical assistance was provided to various local, state, and federal governmental agencies on 50 occasions in FY'92. These organizations were interested in information on:

- ♦ pollution prevention
- ♦ waste handling
- ♦ household hazardous waste disposal
- ♦ Illinois-specific regulations
- ♦ Illinois properties (related to responsible property transfer issues), and
- ♦ technologies for treatment, source reduction, and remediation.

Many agencies, including those from other states, were interested in the pollution prevention resources and services available from the Center.

Educational Institutions

Program staff provided pollution prevention and regulatory assistance on 39 occasions to universities and other educational institutions. These organizations requested assistance with laboratory waste minimization and disposal, environmental regulations and compliance, and trade/technology information.

Pollution Prevention Assessments

A key service provided by the P² Program is pollution prevention assessments for Illinois companies. Assessments include site visits during which HWRIC staff examine a company's processes and operating procedures to identify types and sources of waste. During

such a visit, P² staff discuss management strategies and programs with company personnel to determine the nature and extent of their present pollution prevention programs. Recommendations for pollution prevention strategies are then made to help the companies reduce waste.

P² staff also assist companies with the development and implementation of their pollution prevention programs. Staff work closely with a company and examine all of their processes without focusing on regulatory issues; company personnel can feel confident that no regulatory action will be taken against them as a result of a HWRIC site visit. Consequently, longer term relationships can be established. Company representatives feel comfortable requesting further assistance from HWRIC, and, in turn, HWRIC staff solicit feedback on programs and other issues. With some companies, several visits are necessary to help establish a pollution prevention program.

After developing a protocol for providing pollution prevention assistance and conducting on-site assessments, P² staff conducted eight facility assessments in FY'92. The Center has also developed working relationships with several additional companies to help them implement pollution prevention programs. These companies frequently request information and assistance on a variety of matters.

P² Assessment Site Visits

Abbott Laboratories

Abbott is a major manufacturer of pharmaceutical and other health care products. HWRIC has been working with Abbott representatives to develop a corporate-wide pollution prevention program. Program staff visited Abbott Laboratories to discuss their pollution prevention activities and to tour their North Chicago manufacturing facilities. P² staff will also be working with Abbott to develop laboratory pollution prevention and waste handling training materials.

CCL Custom Manufacturing

CCL Custom Manufacturing, Danville, is a contract packager of aerosols and liquids. CCL handles a variety of household, personal care, food, over-the-counter pharmaceutical, and institutional products. CCL has already

implemented some exemplary pollution prevention strategies such as a Continuous Improvement Program which involves assembling teams of employees from all departments to address specific areas of waste reduction potential. Center staff are working with CCL to expand their overall pollution prevention program and to provide assistance with specific problems. CCL will also provide information to HWRIC on how the employee teams work within the company so that this information can be made available to other facilities.

Eagle Wings Industries

Eagle Wings, Rantoul, manufactures automotive parts, primarily for Diamond Star Motors. The manufacturing processes include stamping, welding, assembling, and painting. P² staff will assist Eagle Wings in the development of a pollution prevention team consisting of employees from all levels and departments. This team will identify and implement waste reduction activities for the plant. P² staff will attend the first few team meetings to ensure that the program progresses.

General Motors (GM)

Program staff visited GM's Central Foundry near Danville to explore ways to reduce specific wastes, including wastewater treatment sludge and foundry sands. P² staff conducted sampling and analysis of GM's wastewater to determine what technologies might be applicable for reducing wastewater treatment plant waste. HWRIC staff then recommended some source reduction techniques which might curtail the amount of contaminants in the wastewater prior to treatment. Further work with GM was suspended when it was announced that GM would be selling or closing the foundry.

Jostens

Jostens has two facilities in Princeton; one manufactures plaques and the other custom jewelry. Jostens had some particular concerns with their plaque etching and jewelry product plating processes. P² staff met with Jostens personnel from both facilities to discuss pollution prevention applications. They also conducted an in-depth assessment of the plaque manufacturing facility and a preliminary assessment of the jewelry plant. Several recommendations were provided for waste reduction for both facilities. Program staff are working with Jostens to

establish a formal pollution prevention program and to routinely provide new, pertinent information on technology alternatives and waste reduction techniques.

Morton Metalcraft (MMC)

MMC, Morton, has already implemented some pollution prevention projects, one of which is designing unique reusable shipping containers for some of their major customers. P² staff are working with MMC to develop a facility pollution prevention program. Program staff routinely provide technical information to MMC and have been instrumental in MMC's implementation of powder coatings, which produce less waste.

Motorola

The Center's P² staff first visited Motorola's Schaumburg facility while participating in a meeting of the company's Environmental Council. In FY'93, P² staff will be working with Motorola's Communications Sector to establish a pollution prevention program. If efforts are successful in this sector, the program will be considered for implementation elsewhere within Motorola. P² staff will also conduct a detailed assessment of the manufacturing and laboratory sections to determine sources of waste and potential reduction techniques. HWRIC staff will work with the Communication Sector waste minimization team to further pollution prevention efforts and formalize a comprehensive program.

R.R. Donnelley

The R.R. Donnelley Mattoon facility is responsible for printing, binding, and shipping magazines, catalogs, and advertisements. The Mattoon operation utilizes both rotogravure and off-set printing. P² staff will be working with R.R. Donnelley to develop an overall pollution prevention program and will be assisting their IEPA summer intern with several waste reduction activities.

C. Clean Technology Development and Demonstration Projects

RRT Program

Illinois businesses and industries may apply for funding and research assistance from HWRIC's Reduction and Recycling Techniques

(RRT) program. The RRT program promotes pollution prevention in Illinois by providing up to \$100,000 per year for applied research. Awards can be obtained for development or demonstration of waste reduction techniques and technologies or for testing new applications of existing methods. These awards must be equally matched by the contractor with either funding from other sources or in-kind services. Projects generally focus on:

- ♦ modifying of industrial processes in order to eliminate, reduce, or substitute for toxic materials; or
- ♦ testing the capabilities of equipment for reducing, detoxifying, or recycling wastestreams.

The RRT program also provides technical support to Illinois businesses and industry to develop ideas into workable projects. HWRIC engineers and scientists are available, upon request, to provide "hands on" assistance with project development, initiation, and management. In order to facilitate these efforts, HWRIC has equipped the pilot laboratory facility with pilot-scale ultrafiltration, reverse osmosis, vacuum evaporation and centrifugation technologies. In FY'92 four graduate students from the UIUC Civil Engineering Department were employed on these projects.

Pilot Laboratory Capabilities

Great strides were made in equipping HWRIC's pilot laboratory facility in FY'92. Pilot-scale equipment that enables the study of numerous in-process recycling options for a variety of process streams was purchased and installed. Listed below are the primary equipment components of the pilot lab and a brief description of their principle functions.

♦ **Centrifugation:** *Balcon M132 Basket Centrifuge* (3 gallons per minute). This unit is used to remove solids from liquids and sludges. It is capable of removing particles down to 5 microns in size. This centrifuge can be used to pre-treat relatively large volumes of waste before processing in the other pilot equipment thereby minimizing the need for pre-filtration.

♦ **Bench Scale Ultrafiltration:** *Amicon 8200 Stirred Ultrafiltration Cell*. This unit facilitates batch screening of candidate membrane materials to be tested on a pilot scale.

In this unit about 100 milliliters of liquid are pressure filtered through various membranes to determine those that are most suitable for specific applications.

♦ **Pilot Scale Ultrafiltration:** *Osmonics 05T-SSXX-UF Ultrafiltration Machine for Process Evaluation.* This unit is designed to conduct ultrafiltration testing on a wide variety of liquids utilizing many different membrane types. Ultrafiltration uses low pressures and relatively large pore membranes to separate emulsified oil, bacteria and other large molecules from process solutions.

♦ **Reverse Osmosis:** *Osmonics 19T-80SSXXC Reverse Osmosis Machine for Process Testing.* This unit is designed to conduct reverse osmosis testing under a wide range of conditions. It is capable of testing many different micropore membrane types under high pressure. This unit is especially effective at removing dissolved solutes such as heavy metals from industrial process streams.

♦ **Vacuum Evaporation:** *Licon C-3 Single Effect Pilot Scale Evaporator.* This unit will evaporate a variety of process solutions at temperatures from 150 to 160° F and functions much like a distillation column. However, by operating under vacuum less heat energy is required. It is especially useful in concentrating solutions beyond the capabilities of ultrafiltration or reverse osmosis systems.

In addition to the equipment described above, HWRIC maintains a full complement of materials-handling equipment to safely deal with bulk materials. This equipment includes pumps, hoists, process tanks, a fork truck, an overhead crane, and fume hoods. The pilot lab equipment is sized and designed to be easily transported to industrial facilities for on-site testing.

New RRT Projects

Three RRT projects were initiated in FY'92 that will be completed in early FY'93. Wastes from two types of industries are addressed in the projects described below.

Utilization of Waste Brine

An Illinois manufacturing facility generates about two million gallons of brine per

year as a wastestream from its amination process. This wastestream is classified as a "special" waste by IEPA, and is currently being landfilled and sent to a wastewater treatment plant. This company does not consider landfilling to be an environmentally sound alternative and has investigated several options on a preliminary basis. These options include: treatment of the wastestream by outside firms or by publicly owned treatment works (POTWs); finding markets for the brine; generating hydrochloric acid and caustics by in-house recycling of the wastestream by either pH adjustment or electrohydrolysis; or generating salt by evaporation and crystallization. An engineering and cost evaluation of each option will be performed.

The research will identify:

- ♦ any necessary pretreatment of the wastestream
- ♦ purity, amounts, and concentrations of the products
- ♦ markets for the products
- ♦ control and treatment of any wastestreams, and
- ♦ fugitive gases.

The company plans to use bench scale equipment to generate the data needed to recommend the implementation of the most cost-effective option and to build a pilot scale plant.

Waste Management Study of Foundries' Major Wastestreams

Even though the metalcasting/foundry industry practices recycling of many materials, it still produces solid, liquid and volatile wastes. The industry estimates that in 1989 over 2% of the production costs of casting were a result of environmental compliance and waste disposal costs. The recent federal Clean Air Act will have far reaching impacts on the foundry industry. The goal of this project was to identify and categorize the origin of foundry wastestreams and emissions. A survey was conducted of the top ten foundry wastestreams of environmental concern. Air emissions from core making, pouring and shake-out operations were found to be of greatest concern and largely uncharacterized. Techniques to minimize these wastes, such as materials substitution prior to control, were explored.

Development and Pilot Demonstration of a Computerized Bar-Code Based Waste Tracking System for Waste Minimization at Argonne National Laboratory

Implementation of a bar-code waste tracking system will allow Argonne personnel to document sources of wastes produced from various research laboratories and identify where wastestreams can be reduced. This tracking system will be tested, documented and made available to other organizations.

Illinois/USEPA WRITE Program Projects

Five projects were undertaken by HWRIC staff with funding from the USEPA under their Waste Reduction Innovative Technology Evaluation (WRITE) Program. These projects will be completed during FY'93. Field testing was completed during FY'92. For some projects a draft final report has been written, while for others laboratory analytical results are pending.

♦ *Hazardous Waste Reduction for a Commercial Iron Phosphating/Degreasing Bath, R.B. White Inc., Bloomington.* Thousands of metal fabricators prepare steel for painting utilizing a phosphating/degreasing process. This procedure involves dipping metal parts into a bath which has been charged with phosphating/degreasing agents. The degreasing portion of the process removes oil rust inhibitors from manufactured parts while the phosphating portion serves as a surface preparation to promote paint adhesion.

R.B. White utilizes a 5,000 gallon bath for phosphating/degreasing metal shelving parts. Emulsified oil builds up in the bath over time, which results in reduced efficiency of the phosphating/degreasing agents. Consequently, the company has to dispose of the bath as an industrial special waste, three times per year, at a cost of \$1 per gallon. Until now, there were no ultrafiltration membranes that could withstand the temperature and pH conditions of these baths. The new membrane used in this study has primarily been developed for the food industry. This application is believed to be the first time an ultrafiltration membrane has successfully removed oil from water under these process conditions.

P² staff conducted pilot and full-scale testing of ultrafiltration equipment at the HML

and at the R.B. White facility. Results indicate that the waste volume generated annually from the phosphating/degreasing process can be reduced from 15,000 gallons to approximately 30 gallons; a reduction of over 99% in waste volume. Additionally, significant reductions in chemical usage associated with recharging the bath solution with phosphating/degreasing chemicals will also be realized. Product quality was improved as a result of implementing this process. The payback period associated with implementing this process is estimated at less than seven months. It is likely that many facilities will benefit from this innovative technology.

♦ *Evaluation of the Effectiveness of Low Temperature Evaporation and Reverse Osmosis for Chemical Recycling/Reuse of Electroplating Rinsewaters, Graham Plating Company, Chicago.* During electroplating operations, metal parts are immersed in a bath containing dissolved plating metals and chemicals. Parts are then conveyed to a series of static rinse tanks to remove residual plating solution. Heavy metals used in the plating process tend to build up in the rinsewater over time until the rinsewater is no longer effective and must be replaced. Sludges from treating electroplating rinsewaters are classified as hazardous due to the presence of heavy metals and, in some instances, cyanide in these solutions.

Graham Plating Company is a medium-sized plating shop that employs 35 people working one shift, five days a week. P² staff worked with company representatives to test two technologies for effectiveness at recycling the rinsewaters. The two technologies, reverse osmosis and low temperature evaporation, were each tested individually. Reverse osmosis uses a pressure-driven membrane separation process in which the plating bath, under pressure, is separated into a purified stream and a concentrated stream by selective permeation of the solution through the semi-permeable membrane. The low temperature evaporation system facilitates cleaning the rinsewater for reuse or discharge to the sanitary sewer. The process also concentrates the plating metals so they can be reused in the plating bath.

Results of this project indicate that both technologies effectively clean up the rinsewater and concentrate the metals. Low temperature evaporation is more effective at processing solutions with relatively high metal

concentrations. Reverse osmosis is more efficient at processing solutions with relatively low metal concentrations. These results further suggest that some operators may benefit from utilization of both systems in sequence. In this scenario, reverse osmosis could be used to concentrate the solution initially, followed by low temperature evaporation processing to further concentrate the solution. Many electroplating shops will benefit from the results obtained in this project.

♦ *P&H Plating, Chicago.* The objective of this project was to develop and implement an innovative recovery and in-process recycling technology to eliminate cyanide and reduce zinc in the company's effluent. The process was converted from zinc cyanide to zinc hydroxide plating. This makes it feasible to precipitate the zinc hydroxide from the rinsewater, recover it by filtration, and recycle it back to the plating bath.

♦ *MPI Label Systems, University Park.* MPI uses a flexographic printing process. In this project, wastes generated from the use of water-based inks and cleaners were compared to wastes generated from the use of alcohol-based inks and cleaners. In-plant measurements were obtained and analyzed. It was found that by switching to the water-based materials air emissions can be reduced by at least 80%. A draft report detailing the environmental and economic benefits of this new technology is being reviewed by USEPA for publication.

♦ *Office of Printing Services, UIUC.* Recently this offset printer began using soy oil inks rather than petroleum-based inks. The objective of this study is to measure the environmental and economic impacts of this change. In-plant measurements of ink and cleaner usage from two identical print runs, each using a different type of ink, were taken during the summer of 1992. The samples are being analyzed and a report will be prepared during the fall of 1992.

D. Governor's Pollution Prevention Awards

In FY'92, HWRIC coordinated the awards ceremony for the Fifth Annual Governor's Pollution Prevention Awards. Governor Jim Edgar's participation was the highlight of the November 14 ceremony held in Chicago. According to Governor Edgar, "The winners of these awards have exhibited a

commitment to protecting our environment. . . They have made an investment in our future that will pay dividends in a variety of ways."

Awards were given to those applicants judged to be of greatest merit in each of seven categories. Other companies with outstanding achievements were presented with certificates of recognition. Out of 51 applicants, 9 awards and 17 certificates were given to companies that employed multiple pollution prevention strategies. The award and certificate winners are listed in Table 6-2 and 6-3 respectively.

At the request of three companies winning pollution prevention awards, the Center's P² staff visited their facilities to make specialized presentations after the official awards ceremony. At Caterpillar, Inc. in Pontiac, the award presentation was made on the facility's plant floor in front of managers and employees. At Champaign's Advanced Filtration Systems, Inc., press representatives and local officials, including the mayor of Champaign, attended a ceremony and reception. Illinois Power also conducted a special ceremony and distributed copies of the award for each of the facility managers who contributed to the company's pollution prevention efforts. Award ceremonies such as these allow companies to share the honors with the employees who made the awards possible.

E. Education, Training and Technology Transfer

Ongoing priorities of the P² program include offering training opportunities to industry and government and providing up-to-date information to educational and civic groups. Conferences and workshops, public presentations, bibliographic databases, factsheets, and other publications are the primary means used to disseminate pollution prevention information.

Workshops and Conferences

HWRIC staff are involved in workshops either as participants/presenters or as sponsors. P² staff were involved in several of these public events during FY'92.

♦ *In Living Color: Painting Challenges of the '90s.* This November 6th national teleconference on paint waste reduction

Table 6-2

Fifth Annual Governor's Pollution Prevention Award Winners

Category	Organization
Educational Institutions	Northwestern University - Evanston
Trade Organizations	Chemical Industry Council of Illinois - Rosemont
Vendors	Nalco Chemical Company - Naperville
Small Facility	Sun Chemical Corporation - Kankakee Sun Chemical Corporation - Chicago
Medium Facility	Advanced Filtration Systems, Inc. - Champaign AGI Incorporated - Melrose Park
Large Facility	Caterpillar, Inc. - East Peoria Illinois Power Company - Decatur

Table 6-3

Fifth Annual Governor's Pollution Prevention Certificate Winners

Category	Organization
Community	Chicagoland Bicycle Federation - Chicago The Aurora Sanitary District - Aurora
Educational Institutions	Streator Township High School - Streator
Trade Organizations	American Electroplaters Society - Chicago
Vendors	Ozoteq, Inc. - Evanston Thermal Fluid Start, Inc. - Plainfield Stericycle, Inc. - Rolling Meadows
Small Facility	Twinplex Manufacturing Company - Wood Dale Chicago Fire Brick Company - Chicago First Brands Corporation - Alsip
Medium Facility	Imperial Eastman - Niles Apollo Colors, Inc - Rockdale Mobil Chemical Company - Joliet Kraft Food Ingredients - Champaign
Large Facility	Honeywell, Inc. - Chicago Abbott Laboratories - Abbott Park Caterpillar, Inc. - Pontiac

for industrial operations was broadcast via satellite. The teleconference was co-sponsored in Illinois by HWRIC, the Illinois Paint Council, the Illinois Manufacturers Association, the State Chamber of Commerce, and IEPA. The conference was telecast in Rockford, Peoria, Oak Brook, Springfield, and Champaign. Presentations included case studies of successful paint waste reduction, discussions of new products and technologies to reduce solvent

emissions, and new regulations for painting operations. There were nearly 100 participants, most of whom represented industry.

♦ *Carl Sandburg College Small Business Center Seminar.* HWRIC P² staff coordinated a panel discussion on hazardous waste management and pollution prevention at this small business seminar in the Galesburg area.

♦ *Illinois Manufacturers Association Conference.* P² personnel staffed a pollution prevention information booth at the conference and presented a talk to the 250 representatives of Illinois businesses. Information was provided on better methods for managing industrial processes and wastes, and for achieving compliance with state and federal environmental laws.

♦ *Metropolitan Water Reclamation District of Greater Chicago.* HWRIC staff continue to participate in the multimedia pollution prevention program of the Metropolitan Water Reclamation District. P² staff members attended a May workshop sponsored by the Chicagoland Chamber of Commerce and made presentations on the definition of pollution prevention, components of a program, and assistance available from the Center. HWRIC's goal for this project is to expand upon present cooperative programs by reaching generators through the District's current pretreatment program. A working group continues to meet regularly to plan specific steps to further cooperation and implementation. HWRIC's educational programs and technical assistance services provide important elements toward the working group efforts.

♦ *Illinois Environmental Protection Agency Intern Training.* As part of this ongoing program, P² staff members provide pollution prevention training to IEPA interns and representatives from the companies that are hosting the interns. The participants discuss specific projects the interns are involved with and how HWRIC staff may be able to assist with these projects.

♦ *Specialty Engineering Foundation Conference on Pollution Prevention.* HWRIC's Director presented a talk entitled "Do We Really Believe in Pollution Prevention?" at this meeting of about 100 experts in pollution prevention. The presentation challenged industry representatives to take a hard look at current waste reduction practices, then look again at how the practices could be improved.

During FY'92, Program staff also made presentations at the Air and Waste Management Association Conference, the Illinois Bar Association, and the Southern Illinois Industrial Association.

Publications

The program continues to develop a series of factsheets on various pollution prevention topics. The factsheets are available at no charge through HWRIC's Clearinghouse. Factsheets compiled in FY'92 include:

Implementing a Pollution Prevention Program (TN93-025). This factsheet emphasizes the benefits of a pollution prevention program and includes a general description of the eight steps associated with implementing a pollution prevention program:

- (1) top management support
- (2) getting started
- (3) characterize process
- (4) identify options
- (5) cost considerations
- (6) select and implement options
- (7) program evaluation; and
- (8) sustain program.

Pollution Prevention Services of the Illinois Hazardous Waste Research and Information Center (TN92-019). This factsheet was developed for use at public events and as a tool for technical assistance site visits. It presents the ways in which all of HWRIC's programs provide valuable resources for pollution prevention.

Waste Reduction in Metal Coating (TN92-020). This factsheet originated as a result of the ultrafiltration process P² staff developed in working with a metal finisher on pollution prevention. The program plans to create similar factsheets on pollution prevention case studies in other industries.

As part of the Pollution Prevention Incentives to the States (PPIS) grant project, a pollution prevention guidance manual is being drafted. The manual is discussed in detail in Section F, below.

Technology Transfer

Technology transfer is facilitated through the collection, organization and distribution of pollution prevention information. HWRIC P², Research and Laboratory Services personnel compile technical information on pollution prevention and waste management strategies

and technologies. HWRIC's primary methods of transferring this vital information to the industrial community include:

- ♦ developing a large clearinghouse and library of pollution prevention literature (see Chapter 5), and
- ♦ developing the Waste Reduction Advisory System (WRAS). The WRAS consists of a survey questionnaire of waste reduction practices and also contains a bibliography citing waste reduction case studies and other information materials.

HWRIC staff have developed an analytical system which can be used for evaluating waste. This system, the "Degree-of-Hazard," is implemented via a computer program, and is based on constituent toxicity and other data (see Chapter 4). The Degree-of-Hazard system is used to identify the most toxic components in wastestreams and to account for changes in toxicity and other waste characteristics that result from waste reduction.

F. Pollution Prevention Incentives for States (PPIS) Grant

The IEPA was awarded a PPIS grant in 1990 to promote pollution prevention throughout the state of Illinois. As part of this grant, HWRIC was subcontracted to perform the following tasks:

- ♦ provide pollution prevention assistance to two industry groups in the Chicago area
- ♦ develop a guidance manual for Illinois industries for implementing pollution prevention
- ♦ provide pollution prevention assistance to Illinois industry statewide, and
- ♦ provide assistance to and develop curricula for higher educational institutions.

Continuous progress was achieved on each of these tasks. Some of these have been modified to make them more realistic and achievable, while maintaining the overall goals of the project. A detailed discussion of progress on the main tasks follows.

Chicago Area Pollution Prevention Assistance Project

The primary goals of the project were to identify priority industry groups in the Chicago Metropolitan area and to assist these industries with pollution prevention programs. The Chicago Metropolitan Area was defined as Cook, DuPage, Lake, Kane, Will and McHenry counties. The elements of this project included: target industries selection; industry research; definition of industry needs; site visits with followup; assessment worksheet development; and industry workshops.

Target industries selected were the printing and the chemical industries of Illinois, categorized by Standard Industrial Classification (SIC) codes 2700 (printing) and 2800 (chemical). These industries were ranked first (SIC 2800) and second (SIC 2700) on the toxic release inventory lists in 1987 and 1988 for releases of USEPA's 17 priority chemicals. In 1989, they were ranked first (2800) and third (2700) on this list.

Representatives from the Chemical Industry Council of Illinois and the Printing Industry of Illinois and Indiana were contacted to determine their pollution prevention needs and receptivity to technical assistance. As a result of these contacts, a site visit form was developed, and P² staff made site visits to eight printers in the Chicago area and one printer in Mattoon (R.R. Donnelley). The Chicago area printers visited included: Abbott Laboratories, Graftek, Fort Dearborne Lithography, Solar Press, Lake County Press, Curtis 1000, MLS Printing Co., and Cushing Graphics. Reports documenting discussions held during the visits and suggestions to support pollution prevention in the facilities were prepared for Abbott, Graftek, Fort Dearborne Lithography, and Lake County Press. These reports have been sent to the facility contacts. No project site visits were made to Chicago area chemical companies; however, some related site visits have been conducted with other industries in the state.

Recommendations HWRIC staff made to the printers included:

- ♦ introducing specific suggestions for implementing a pollution prevention program, such as writing a formalized program plan including a written corporate policy statement

- ♦ designating a pollution prevention coordinator and establishing a team from all areas and management levels at the facility
- ♦ educating employees about pollution prevention and how it relates to their jobs
- ♦ setting goals for the reduction or elimination of wastestreams
- ♦ beginning waste tracking
- ♦ defining production units to facilitate better tracking of wastes generated
- ♦ determining the true costs of waste generation to the companies
- ♦ publicizing and transferring successful technologies, and
- ♦ conducting periodic reviews to redefine and update goals.

Recommendations included investigating the use of vegetable-based inks and less toxic alternatives for cleaners. P² staff made a followup visit to Abbott Laboratories and learned the Abbott printshop implemented the major recommendation of replacing solvent-based inks with soy-based inks. The shop is continuing to evaluate and implement additional HWRIC recommendations. Graftek is currently trying to arrange a followup visit to their facility. Followup contacts with all the companies will be made by telephone, letters or additional site visits. Followups will allow P² staff to determine if the suggestions were helpful and if any of the recommendations were implemented. All followups should be completed by the beginning of November 1992.

Factsheets for the printing industry have not yet been developed. Factsheets will be drafted when the information from the followup with the printers has been obtained. A factsheet on pollution prevention was desirable for the chemical industry. However, it is such a large and diverse industrial group, P² staff ended up producing a more general factsheet appropriate for any industry group.

Workshops for industry have been tentatively scheduled for the fall of 1992. The target groups for these workshops are all industries in Illinois that have an interest in pollution prevention. These workshops will focus on planning and implementing pollution prevention programs with a focus on management approaches.

Some of the original tasks for PPIS will not be completed. The focus on the chemical industry has been changed, in part because the outreach effort to the chemical industry was not as successful as that to the printing industry. The chemical industry is diverse and staff in these companies generally possess a great deal of expertise on chemical processes. They are generally not receptive to outside technical assistance. For this project HWRIC is therefore focused on:

- ♦ specific pollution prevention techniques (such as management awareness)
- ♦ certain chemical processes that are amenable to pollution prevention, and
- ♦ specific facilities that are receptive to assistance.

The outreach effort through the Printing Industry of Illinois and Indiana had some positive results. The site visit to Abbott Laboratories' printshop allowed for expansion of efforts to assist the company in other divisions. This assistance is still in the beginning stages but P² staff have met with representatives from Abbott's corporate environmental group and will be working with them to implement pollution prevention training for their researchers.

Guidance Manual

The goal of this task was to draft and distribute a pollution prevention manual that all industries could use to implement and sustain pollution prevention programs. This task is being accomplished through collection and review of other state's documents, preparation of an outline, dissemination of a draft document, and evaluation of the draft document use. An outline was developed after reviewing waste minimization manuals for the states of Minnesota, Washington, and Tennessee. It was then distributed for comments to representatives of Citizens for a Better Environment and IEPA's Office of Pollution Prevention.

The manual is modeled after the six steps detailed in the USEPA's draft manual *Guidance to Hazardous Waste Generators on the Elements of a Waste Minimization Program*. HWRIC's manual outlines a straightforward approach to pollution prevention. It recommends use of the USEPA manual as a

reference source, since that document provides additional details on individual steps toward implementing pollution prevention.

The HWRIC guidance manual will be distributed for industry review. Up to 200 manuals will be distributed at the Illinois Manufacturers Association Conference in September 1992, and the Partners in Prevention Conference in October 1992. Comments concerning the appropriateness and usefulness of the manual will be requested from as many facilities as possible. These comments will be of great value for a future revision.

Develop Pollution Prevention Assistance and Curricula for Illinois Higher Education Institutions

The main goals of this task were to develop curricula to be used by Illinois higher education institutions and assist these institutions with pollution prevention. This task is being achieved through research funded by HWRIC's Research Program. Five projects have been funded:

- ♦ Illinois Higher Education Survey
- ♦ Automated Database Tracking of Chemical Usage at the University of Illinois (see FY'91 Annual Report)
- ♦ Determination, Implementation, and Evaluation of Laboratory Waste Minimization Opportunities (see FY'91 Annual Report)
- ♦ Pollution Prevention Course at the Illinois Institute of Technology (see Chapter 3 of this report), and
- ♦ Pollution Prevention and Total Quality Management: Curricula for Schools of Business and Public Health.

The Illinois Higher Education Survey project is being conducted in two phases by the University of Illinois' Survey Research Laboratory (Chicago and Urbana-Champaign campuses). The first phase objective has been completed. It involved obtaining information on the existence of waste management practices at 50 Illinois institutions by identifying a contact at each institution who was familiar with their waste management practices. Each contact was asked to advise HWRIC on what sort of assistance they could use in managing their waste. The responses from the first phase included requests for assistance on: compliance with environmental regulations; laboratory safety

requirements; generator status; and permit requirements. During the second phase of the project a detailed questionnaire will be sent to each contact.

The goal of the survey is to obtain information on specific wastestreams generated at institutions of higher education, the source for these wastestreams, and how the wastes are currently being treated or disposed. These data will help identify techniques and technologies that can be used to prevent and reduce waste.

G. Future Plans

FY'93 Clean Technology Development and Demonstration Projects

Beginning in January 1992 preproposals for FY'93 projects were solicited through the HWRIC Mailing Outreach Database (MOD) and announcements in newsletters and journals. Twelve preproposals were submitted in response to the solicitation, and were reviewed internally. A similar solicitation and review process will be used in FY'93 for FY'94 projects, provided that state funds are appropriated for this effort. Due to reduced appropriations for FY'93 (down from \$100,000 to \$40,000) only three new projects could be funded. The three projects, summarized below, are expected to be completed in FY'93.

♦ *Emulsified Oily Water Reduction at A.O. Smith Corporation, Granite City.* A.O. Smith manufactures automotive structural components at this facility. Petroleum-based lubricants are utilized in the various presses that cut and shape the steel parts. These lubricants ultimately are discharged into the sanitary sewer which may cause regulatory compliance problems. P² personnel will work with A.O. Smith engineers to test an ultrafiltration system for removing emulsified oil from their process solutions and should improve the quality of the discharge water. Additionally, alternative lubricants will be tested to determine if a suitable, less hazardous lubricant, can be found to replace the petroleum-based lubricants without sacrificing product quality.

♦ *Die Cast and Oil Waste Reduction at Outboard Marine Corporation (OMC), Waukegan.* OMC manufactures component parts for outboard motors and stern driven engines at their Waukegan facility. Over 6 million pounds of waste are generated annually. Metal cleaning

and wastewater treatment associated with maintenance and cleanup operations account for 29% of the total waste. Die cast and oily waste associated with die lubrication, machine sumps, hydraulic components, and water soluble coolants comprise about 64% of the total waste. In this project, OMC and HWRIC personnel will investigate the potential of ultrafiltration and low temperature evaporation systems to reduce waste volumes and determine the potential for recovering raw materials from the wastestreams. The most economically-effective technology will be implemented.

♦ *Process Development for Treating Refinery Waste Sludges and Recovering Oil, US Emulsion Technologies, Inc. (USET), West Chicago.* US Emulsion Technologies specializes in utilizing surface chemistry principles and emulsion formulation theory for solving environmental problems. In this project, USET staff will work with HWRIC personnel to pilot test an innovative system they have developed for treating refinery sludges. Refinery sludges are the solidified materials which accumulate in the bottoms of refinery tanks and vessels. USET's treatment system will involve two steps: 1) emulsifying the sludge in order to make it easy to remove from storage tanks; and 2) separating the removed sludge into its principle components of solids, oil, and water. The oil can then be reused in the production process. The water can also be reused or possibly discharged to the sanitary sewer. The solids, the only remaining waste material, would comprise much less volume than the pre-treatment sludge.

This system could have broad applicability to refineries and other interests that store oils and fuels. If the system results in material recovery, economic benefits will increase while the amount of waste disposed will decrease.

Governor's Pollution Prevention Awards

The focus for the awards program is on the benefits achieved from source reduction and materials reuse activities, along with organizational commitment to a pollution prevention program. P² staff are coordinating the Sixth Annual Governor's Pollution Prevention Awards with winners to be announced in fall 1992. HWRIC is responsible for distributing applications, assisting potential applicants with completing the application form, and evaluating the applications for technical

merit. The evaluations are based solely on the information provided in the applications. Following a compliance review by IEPA, the Center makes a recommendation of award winners to the Governor's Office; the Governor's Office makes the final selections.

HWRIC received 61 applications in FY'92 for the sixth annual awards to be presented in FY'93. Categories of organizations, and the number of applications received for each, are:

- community organizations (2)
- trade organizations (2)
- vendors (4)
- small facilities (14)
- medium facilities (17)
- large facilities (22).

The number of applications received has greatly increased over the past few years. The quality of the applicants' projects has also significantly improved.

Based on the evaluations, 18 companies have been recommended to the Governor's Office for awards or certificates (see Table 6-4). Several different pollution prevention strategies were utilized by the applicant companies; process modifications and/or substitutions and material substitutions were the most common.

Table 6-4

Sixth Annual Governor's Pollution Prevention Awards

Category	Number of Award Winners	Number of Certificate Winners
Community	0	2
Trade Organization	1	1
Vendor	1	2
Small Facility	2	3
Medium Facility	2	4
Large Facility	3	4

Other pollution prevention techniques reported were: implementation of a pollution prevention program including management support, employee participation, and training; source segregation and general operational improvements; and in-process/on-site reuse and recycling. The average number of strategies reported by these companies were 2 for small facilities, 2.5 for medium facilities, and 3 for large facilities.

The techniques recognized for the community organizations were collection programs for recycling or reuse of materials for energy recovery. The vendors also offered recycling or reclamation services. Promotion and support of pollution prevention and reuse

programs were the strategies recognized for trade organizations.

Education, Training and Technology Transfer

A more concerted focus on educational efforts is planned for FY'93. Additional education and training at all levels, including elementary and secondary schools, professional associations and industrial facilities, will help ensure that pollution prevention is widely adopted in Illinois. Table 6-5 lists possible avenues of providing pollution prevention information to HWRIC's constituencies. A program goal is to investigate all of these avenues, and implement some of them, during the coming year.

Table 6-5

Future Pollution Prevention Educational Developments	
Audience	Products
Schools - K-12	Develop classroom activities focusing on pollution prevention concepts.
	Provide in-service workshops for teachers on the use of materials.
	Develop an in-service program for teachers to learn more about hazardous waste/pollution prevention scientific research and analytical methods.
	Attend the Illinois Science Teachers Association annual meeting and provide information on resources available at HWRIC.
Schools - Community Colleges, Trade Schools, 4-year Colleges and Universities	Develop lectures on pollution prevention for inclusion in engineering, health sciences, business, and law courses.
General Public	Develop factsheets on topics of use to a wide audience, such as proper disposal of paint, household hazardous waste alternatives, etc.
	Increase public information dissemination on pollution prevention successes through press releases to papers across Illinois.
Environmental Organizations	Develop a mailing to determine informational needs of these organizations in order to develop a proactive outreach program.
Industry	Develop a workshop suitable for presentation to all types of Illinois industry on HWRIC's pollution prevention manual.
	Develop workshops on specific technologies or techniques for appropriate industrial audiences.
	Expand base of Illinois industry specific case studies through documentation of successful companies in Illinois and add to the WRAS, PPIC and ICPIIC databases.
	Develop additional industry-specific factsheets.

Pollution prevention workshops and teleconferences with which HWRIC will be involved in FY'93 are listed below.

- ♦ a solvents waste reduction teleconference to be broadcast in Illinois on February 11, 1993
- ♦ an electroplaters' workshop to be held in Chicago on November 12, 1992, cosponsored by the Metropolitan Water Reclamation District of Greater Chicago, the Association of Electroplaters and Surface Finishers, and the Chicago Metal Finishers Institute, and
- ♦ an iron and steel conference to be held October 14-15, 1992, cosponsored by USEPA and the American Institute of Pollution Prevention.

Work has begun on the Waste Paint Education Project, funded by the Environmental Protection Trust Fund. The project, which will continue in FY'93, involves developing educational brochures, factsheets, and workshops on the proper use and disposal of paint. The factsheets will be targeted for a variety of audiences, including homeowners, contractors, realtors, autobody shop owners, and small quantity generators.

The WRAS will be integrated with the pollution prevention databases from USEPA's Pollution Prevention Information Clearinghouse (PPIC) and the United Nations International Cleaner Production Information Clearinghouse (ICPIC).

Early in FY'93 initial funding is expected from the USEPA's Region 5 office to begin publication of a newsletter to facilitate communication between the Region's six states and USEPA. During FY'93, four issues of this newsletter are planned. If the newsletter is deemed to be valuable, it is likely that continuation funding will be provided. This project will provide HWRIC with the most current information on successful approaches to state pollution prevention programs and potential federal funding. This will allow HWRIC to improve our technology transfer efforts to industries in Illinois.



Appendix A: Fulltime Staff Papers & Presentations FY'92

- Bailey, Martin B., Gary D. Miller and Laurie J. Case. 1992. *Degree of Hazard Evaluation Program and User's Guide*. Includes diskette. Champaign, IL: Hazardous Waste Research and Information Center.
- Cappo, Kevin A. 1992. *Hazardous Materials Laboratory Chemical Hygiene Plan*. Champaign, IL: Hazardous Waste Research and Information Center.
- Case, Laurie. 1992. "Stewardship -- A Personal Perspective: An Interview with Lee and Joyce Ashby." *The Illinois Steward* 1 (1): 1.
- Cochran, Jack, Martha Avery and Jeff Dawson. 1992. "Sample Preparation and Analysis for Carbon Tetrachloride in Cottonwood Trees." Presented at the Fourteenth International Symposium on Capillary Chromatography. (Baltimore, MD. May 29, 1992)
- Colten, Craig E. 1992. "Illinois Historical Hazards Geographic Information System." Presented at the Mid-America GIS Symposium. (Kansas City, KS. May 6, 1992)
- Colten, Craig E. 1991. "Illinois Sanborn Geographic Information System." IN *Proceedings of the 34th Annual Engineering Geologists Meeting*. (Chicago, IL. October 3, 1991)
- Colten, Craig E. 1992. "Impact and Policy: Illinois River Pollution Control, 1900-1970." Presented at the Environment and the Industrial World Seminar, Hagley Museum and Library (Wilmington, DE. May 8, 1992)
- Colten, Craig E. 1992. "Landscapes of Conflict: The Rocky Mountain Arsenal." Presented to the Association of American Geographers (San Diego, CA. April 19, 1992)
- Colten, Craig E. 1991. "Landscapes of Risk." Presented at the Rocky Mountain Arsenal Refuse Design for the 21st Century Conference (Denver, CO. November 16, 1991).
- Colten, Craig E. 1991. "Preparing Adequate Site Histories: Qualifications, Sources and Products." pp. 177-88. IN *Proceedings of the National Water Well Association Environmental Site Assessment Case Studies and Strategies Conference*. (Columbus, OH. July 30, 1991)
- Colten, Craig E. 1992. "The Urban Garbage Frontier: Chicago's Waste Lands." Presented at the Chicago Historical Society Urban History Seminar (Chicago, IL. February 20, 1992).
- Colten, Craig E. and Shelley Bookspan. 1991. "A Historian's View on Preparing Adequate Site Histories." *The Environmental Liability Report* 3 (8): 4-6.
- Colten, Craig E. and Shelley Bookspan. 1992. "Preparing Adequate Site Histories." Reprinted in *Public History News* 12 (2): 12.
- Crane, J.L. and P.P. Tazik. 1992. "Catalog of Types of the Illinois Natural History Survey Mycological Collection (ILLS)." *Illinois Natural History Survey Bulletin* 34 (6): 535-550.
- Damon, Lisa. 1992. "Guide to Environmental Databases in Illinois." Presented at the Lake Michigan States Section, Air & Waste Management Association Conference. (Chicago, IL. January 31, 1992)

Garver, John and Lisa Damon. 1992. "Using Illinois Environmental Databases as a Resource for Preliminary Site Assessments." Presented to the Chicago Bar Association Environmental Attorneys Group, Hazardous Waste Research and Information Center. (Champaign, IL. April 24, 1992)

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